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VOL. XIV. NEW YORK, OCT. 5, 1889. No. 14.

The Pieper Lamp. NOTE is made in our columns this week of a very simple and ingenious form of arc-incandescence lamp, called the Pieper. It is evidently one for which a place exists in the field of electric lighting, and we should not be surprised to see it adopted quite extensively in this country.

A Foe to Bad Morals. A PETITION recently laid before the Oakland, Cal., city trustees for electric lighting says that "the aforesaid light would do away with a good deal of bad morals." This is naively put, but we believe it to be the universal testimony of policemen and the public alike that the penetrating, searching beam of the electric light is an effective moral agency. If not reformative, it is at least deterrent.

Another Thomson Experiment. IN his very interesting correspondence from the Paris Exposition, appearing this week, Mr. Wetzler gives an account of the new Pieper lamp, and of another novel experiment made by Prof. Elihu Thomson, whose illustrations of various induction phenomena have already been described in our pages. Here we have the direction of rotation of a wheel the very opposite of what we would naturally expect, and resulting in some unexplained manner from reactions produced by the alternating current.

The Patent Office Year. MR. W. A. ROSENBAUM presents in our issue this week an interesting analysis of the annual report of the Patent Office, just made by Commissioner Mitchell. The figures present vividly the activity of the country in invention, and bring out once again the fact that while the Patent Office pays its way handsomely, it is one of the worst salaried and worst provided departments of the government. This should not be, and we trust that Mr. Mitchell may have the credit of changing this state of affairs during his term of office. The recommendations made by Mr. Mitchell, as to desirable amendments in patent law, will have general approval, as, indeed, will any proposal looking to simplicity and uniformity of practice.

Measuring Mutual Inductance. WE publish on another page a very ingenious method for measuring mutual inductance put forward by Mr. A. E. Kennelly. It consists in applying Clerk Maxwell's method for self-inductance to the measurement of mutual inductance, employing a Wheatstone bridge, condenser and Ayrton-Perry secohmmeter. In the ordinary method for mutual inductance it is almost impossible to attain a balance with a condenser of fixed capacity, and the accuracy also depends largely on the time constant of the coil. These objections are completely obviated by Mr. Kennelly's arrangement, with the further advantage that the two measurements of self-inductance and mutual inductance can be quickly and successively performed by a simple change in the bridge ratio.

The Electrical Census. IT is with much pleasure that we announce the appointment of Mr. A. R. Foote, of Cincinnati, O., as the officer to conduct the statistical investigation of the electrical industries of this country, in connection with the next census. The work is one peculiarly suited to Mr. Foote's tastes and abilities, and we have no doubt that he will render the report highly interesting and successful. It is, indeed, high time that such a review of the status of electrical developments were taken. The last census gave little, and before that there was nothing. Since 1880 the growth of electricity has, as everybody knows, been tremendous and bewildering in its extent; yet no one is in possession of all the desirable and needful statistics of the subject, and no one can be until the authority of the central government itself goes with the inquiry and supports the agent intrusted with the task. Even in its earlier stages the work will bring out suggestive facts.

The Design of Transformers. MR. JAMES SWINBURNE, in his British Association paper, points out the fact that instead of closed circuit transformers, which are connected permanently, having a high efficiency under small loads, they are excessively wasteful, absorbing a large percentage of energy by hysteresis, since their full load is only on very occasionally, while the loss by reversal is continuous. He concludes from the fact that the efficiencies of modern transformers are generally given at something like 98 per cent., that the loss in the iron is not taken account of. To overcome this, we must take a step backward, so to speak, and use an open circuit transformer of the original Gaulard type. A very similar view was once entertained of the alternating current dynamo, which was considered of little utility compared with the continuous, but to-day has re-asserted itself and holds a very prominent position. It may be thus with the open circuit transformer, which, of course, has the argument of economy on its side.

Storage Battery Street Cars. DR. LOUIS BELL contributes to our pages this week a very able article on storage battery street cars. He makes a careful study of the subject, goes into all the various conditions affecting such cars, and comes to the conclusion that, in spite of the many advantages attendant upon their use, they cannot compete with cars supplied with current from overhead wires. The standpoint, practically, is that of the street railway manager, not that of the public, and is probably the governing one in most cases, though if the likes and wishes of the public were consulted, the plebescite would, we believe, go in favor of the storage cars. Some of the objections to storage cars suggested by Dr. Louis Bell will remain, just as many of the objections to overhead systems may remain, but he would be an unwise man who did not expect radical improvements in batteries designed for this class of work. There are good batteries to-day, but we may see great strides, and in the meantime it is inevitable that such a clean, pleasant, unobstructive method should grow vastly in popularity.

Electric Launches in England. THE philosopher at play is not less willing to make scientific observations than when he is actively engaged in his wonted work, and thus we find Prof. George Forbes bringing before the British Association some valuable notes on the storage launches that have been placed upon the upper waters of the Thames. His narrative is so charming that one is inclined to class him among the Clark Russells, or better yet, with the William Blacks. He shows, as it has not been shown before, how much scientific information, as well as agreeable recreation, may be derived from the ownership of an electric launch, and makes one envy him that pleasant trip through the reeds and reaches of the Thames. It will be seen that Prof. Forbes makes a number of suggestions as to the improvements that can be effected in such launches, and we should be happy to know that they were as likely to be followed up here, on the Hudson, or Schuylkill, or Potomac, or Charles as on the Thames. The many charms of the electric launch are not yet realized by American yachtsmen and boating men as they should be.

The Awards at Paris. CABLE advices from Paris bring the welcome news of a large number of high awards to Americans at the Paris Exhibition. The list was announced on Sept. 29 by M. Tirard, at the Palais de l'Industrie. The American Bell Telephone Company, Thomas A. Edison, Elisha Gray and Elihu Thomson receive Grand Prizes, and gold medals are awarded to the Western Electric Company, the Cobb Vulcanite Wire Company, the Okonite Company, the Volta Graphophone Comwany and the Sprague Electric Railway and Motor Company. The Sperry Company have received a silver medal and honorable mention. It is interesting to note also that a Grand Prize has been awarded the United States Signal Service, and that Johns Hopkins University and the Rensselaer Polytechnic Institute also receive Grand Prizes; while the Massachusetts Institute of Technology, Cornell University and the University of Michigan receive gold medals. Prof. H. A. Rowland is distinguished with a gold medal for his beautiful photographs. We beg to tender our warmest congratulations to all these recipients, and trust they will feel rewarded for their efforts in contributing to the greatest and grandest exhibition that has yet been given.

Electricity in Warfare. THERE are legitimate as well as illegitimate methods of employing electricity as a means of destroying life; and of these legitimate methods a very interesting account is given by Lieut. W. S. Hughes, U. S. N., and Lieut. J. Millis, U. S. A., in the October issue of *Scribner's Magazine.* These articles are among the best in the series now being published by that popular periodical, and will do much to enlighten the general reader on the great value of electricity in modern warfare on land and sea. Lieut. Hughes gives an excellent account of the various uses of electricity on shipboard, not forgetting the recent introduction of electric motors; and his illustrated description of search lights will be found useful, especially by several of our subscribers who have been asking us lately for details. The article by Lieut. Millis is also an admirable survey of the work done in utilizing electricity in the army, and like that by Lieut. Hughes, it makes an interesting reference to balloon operations. With regard to the results that may be obtained from electrical torpedoes and electrically-assisted dynamite guns, Lieut. Millis makes the pertinent remark that there is a tendency to overestimate their importance. This is true, and while there is still need for an extension of the torpedo service, there is an equal need for better coast fortifications than can now be shown on either the Atlantic or the Pacific seaboard. We recommend these two articles for careful perusal. They are full of data, and contain many suggestions for the electrical inventor.

Busybody Heinrichs. JUST exactly what Mr. C. T. Heinrichs' motives are in blackening the arc light system, in a communication he addressed to Mayor Grant last week, it is hard to say, but it may be safely assumed that they are not of the strictly philanthropic order. Mr. Heinrichs is, himself, the inventor and promoter of an arc light system which he has failed to get upon the market, and for him to prate as he does about the "avarice of the great high-voltage combination" is, therefore, grotesque and absurd in the extreme. The idea of the inventor of an arc light system lecturing the mayor about "the deadly nature of the high voltage of electric currents used in this city" and telling him what his duty is, must go upon record as one of the most colossal pieces of cheek and buncombe that the current year has seen, and it has been an exceptional year, too. Mr. Heinrichs is not satisfied, however, with instructing the mayor in the duties of the chief magistracy, but has the further audacity to declare that "a great number of professional electricians and scientists have rashly or imprudently *misrepresented* the causes and circumstances of the accidents by high-voltage currents, and *pretended* to be unable to tell approximately the voltage of the current or the electrical energy which has or will cause death to human beings." We know of but one such man active just now, and that one is Mr. Heinrichs, who is making himself a nuisance, and who, if he thinks to promote his personal ends by attacking the arc light industry and by stabbing at professional reputations in this way, was never more mistaken in his life. The Board of Electrical Control and its excellent expert, Dr. Wheeler, can get along very well, also, without his gratuitous advice and assistance, as to the framing of new "police regulations."

NEW BOOKS.

A Dictionary of Electrical Words, Terms and Phrases. By Prof. E. J. Houston, A. M. The W. J. Johnston Co., Ltd., New York, 1889. 656 pp., 397 illus. Price, $2.50.

Professor Houston's Dictionary of Electricity is valuable for two reasons: In the first place the work is conscientious and intelligent; and, in the second place, a book of the kind has been very much needed. In the past few years the number of electricians and of persons more or less interested in electrical matters has greatly increased, while the number of new terms proposed or adopted, together with the rapid increase in electrical applications and discoveries, have made the reading of even the most popular article on the subject a difficult matter to a layman; and such is the tendency to specialization that even to-day a storage battery electrician is liable to fall foul of an alternating current electrician on a matter of definition. But with this book at hand no one can be at a loss to understand the meaning of an electrical term nor can be in doubt as to the function or working of any instrument or apparatus.

As for the plan of the book, the terms—there are some 2,500 of them—are first briefly defined, and then, when necessary, an explanation is added, occupying sometimes several pages, and often accompanied with illustrations. It is difficult to find any words that have been left out, the only really important one that I can discover being the "time-constant" of a circuit, while a number of terms have been included which are not electrical at all, but which one runs across sometimes in reading electrical works. For instance, opening the book at random, I find on two pages "gimbals," "gold bath," "governor," "centrifugal," etc.

As far as the descriptions of apparatus and instruments go there is nothing to be desired; they are clear, concise and admirably simple. And in general the definitions and explanations are good, although they are not always as accurate as they might be. They seem to be the work of one who is not both a physical and mathematical electrician but who is a physical as *distinguished* from a mathematical electrician. While the manner of them is excellent, yet there is sometimes an absence of exactness and of a certain quantitative quality which they should have. For example, our ideas of magnetic force, induction and permeability and of their relations should be as definite as is our knowledge of Ohm's law. Suppose, not knowing much about these quantities, we read that the induction in the armature of a dynamo is 15,000 lines to the square centimetre, there being a certain number of ampère turns around the field magnets. Looking for the definition of magnetic induction we find that it is the "production of magnetism in a magnetizable substance by bringing it into a magnetic field;" but we do not find in the definition or explanation any hint of the relation between force and induction, nor do we find it under the head of "force" or "permeability." Under magnetic susceptibility the relation is indeed imperfectly stated, but it has no right to be there, and we find in several places an inexplicable confusion between induction and magnetization and their coefficients.

Although there is some looseness of statement in the definitions, there is little real inaccuracy, and in a book in which electrical terms are briefly translated into non-technical language a certain freedom is permissible. There are faults in the book, but they do not obscure its real excellence, and there are few people interested in electricity who will not be helped by it. Louis Duncan, Ph. D.

A Convenient Null Method of Measuring Mutual Inductance by the Use of a Wheatstone Bridge, Condenser, and Ayrton-Perry Secohmmeter.

BY A. E. KENNELLY.

This method can lay no claim to novelty in its principles being simply the adaptation of that devised by Clerk Maxwell for self-inductance only, to the determination of mutual inductance also; and, in fact, a diagram of the arrangement appears in an excellent paper on the measurement of self-induction, mutual induction and capacity, read in May 1887, before the London Institution of Electrical Engineers by Mr. W. E. Sumpner; but the convenience and precision of which the method is practically capable, when used accumulatively in conjunction with the Ayrton-Perry secohmmeter, probably entitle it to equal consideration with the method specially designed for the instrument by those gentlemen, and fully described in their paper read at the same May session above referred to.

Clerk Maxwell's method for measuring the inductance l of a coil d consists (Fig. 1) in obtaining an ordinary Wheatstone bridge balance with a steady testing current, and then balancing the discharge from the coil by the discharge from a condenser k, shunting the opposite arm, when that current is rendered intermittent or variable. This complete balance being attained gives the relation

$$l = b\,d\,k,$$

k being measured in farads, b and d in ohms, and l in quadrants.

The well-known objections to this method are, 1st, the great difficulty attending the practical attainment of balance with a condenser of fixed capacity; and, 2d, that when the measurements are made with coils of large time-constant, the discharges from coil and condenser are not exactly coincident, and thus produce undue disturbance on the galvanometer. The first objection is completely met either by connecting the condenser to sliding resistances in the bridge, as shown by Mr. E. C. Rimington in the London *Electrical Review* for October 7, 1887, or equally well by the adoption of adjustable subdivided condensers, which are now in fairly general use. The second objection is also largely overcome by the aid of the Ayrton-Perry secohmmeter, by which the

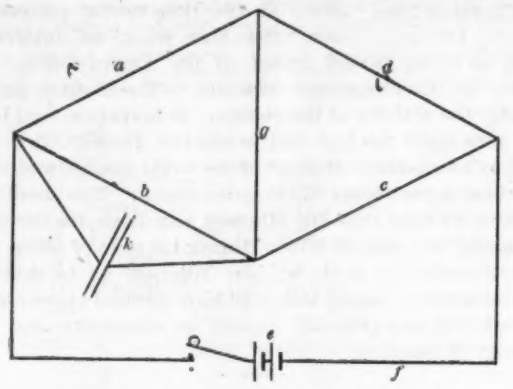


Fig. 1.

battery and galvanometer are each commutated in due succession, so that, with these modifications, Clerk Maxwell's method becomes speedy, convenient and reliable.

If the inductance k b d or l of the coil on itself be thus determined, the introduction of a second coil s magnetically linked with d into the battery circuit, as shown in Fig. 2, will upset the balance, owing to their mutual inductance μ, and will render necessary a readjustment of the condenser from k to k_1 when rotating the secohmmeter, then

$$\mu = \frac{a\,b\,d}{a+b}(k \sim k_1),$$

or, if n be the ratio $\frac{b}{a}$ of the bridge,

$$\mu = \pm \frac{n}{n+1}(k_1 b d - l)$$

the selection of the upper or lower sign depending upon the direction of the battery current in the coil s, and thus upon the direction of the readjustment in k; but no ambiguity is possible, since that sign must be taken, which makes μ positive. Thus the two measurements of self and mutual inductance can be readily performed in quick succession, a change in the bridge ratio, at most, being necessary.

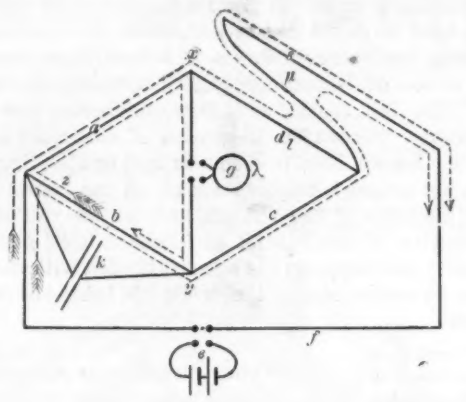


Fig. 2.

In this respect the plan resembles that more generally used with the secohmmeter, namely, that in which the disturbance of the galvanometer for commutated currents is made to disappear by a suitable adjustment of the resistance instead of a condenser, a readjustment being made when the coil s is brought into circuit, the two changes determining l and μ successively. Both these methods may at times be advantageously used as a check upon each other, and the condenser method has the advantage of not requiring a standard inductance or the knowledge of the secohmmeter constant.

One or two actual measurements are given in the accompanying table, followed by the general mathematical proof:

In Fig. 2—

Let a, b, c be three arms of the Wheatstone bridge, having negligible inductance, and also their respective resistances.

Let g be the galvanometer and also its resistance.

Let λ be the inductance of the galvanometer in quadrants.

Let d be a coil of inductance, l quadrants, measured or known.

Let s be a second coil of inductance, s quadrants, whose mutual inductance μ on d has to be measured.

Let k be an adjustable condenser, and also its capacity in farads.

Let ε be the E. M. F. of the testing battery.

Let f be the resistance in the battery circuit, including that of coil s.

Let x, y, z be the current strengths in the bridge at any instant as shown.

Let q be the charge in the condenser at any instant.

Let n be the bridge ratio $\frac{b}{a}$

Then let the balance $\frac{a}{b} = \frac{c}{d}$ be first effected, and also the balance for varying currents when rotating the secohmmeter (which is only partly represented in the figure) by adjusting k. Then at any moment the following equations of motion apply:

$$\varepsilon = f(x+y) + a(x+z) + d\,x + (l \pm \mu)\frac{d\,x}{d\,t} + (s \pm \mu)\frac{d(x+y)}{d\,t} \quad (1)$$

$$\varepsilon = f(x+y) + b\left(y - z - \frac{d}{d\,t}\frac{q}{t}\right) + c\,y + s\frac{d(x+y)}{d\,t} \pm \mu\frac{d\,x}{d\,t} \quad (2)$$

$$-\lambda\frac{d\,z}{d\,t} = a(x+z) + g\,z + b\left(z - y + \frac{d}{a\,t}\frac{q}{t}\right) \quad (3)$$

These three equations yield after the elimination of x and y,

$$\Delta\,z = A + B\frac{d\,x}{a\,t} + C\frac{d\,y}{d\,t} - D\frac{d\,q}{a\,t} - E\frac{d\,z}{d\,t} \quad (4)$$

where
$$\Delta = \begin{vmatrix} a+d+f & f & a \\ f & b+c+f & -b \\ a & -b & a+b+g \end{vmatrix} \quad (5)$$

$$A = \begin{vmatrix} \varepsilon & a+d+f & f \\ \varepsilon & f & b+c+f \\ o & a & -b \end{vmatrix} \quad (6)$$

$$B = \left\{ -(l \pm 2\mu + s)\begin{vmatrix} f & b+c+f \\ a & -b \end{vmatrix} + (s \pm \mu)\begin{vmatrix} a+d+f & f \\ a & -b \end{vmatrix} \right\} \quad (7)$$

$$C = \left\{ -(s \pm \mu)\begin{vmatrix} f & b+c+f \\ a & -b \end{vmatrix} + s\begin{vmatrix} a+d+f & f \\ a & -b \end{vmatrix} \right\} \quad (8)$$

$$D = b\left\{ \begin{vmatrix} a+d+f & f \\ a & -b \end{vmatrix} + \begin{vmatrix} a+d+f & f \\ f & b+c+f \end{vmatrix} \right\} \quad (9)$$

$$E = \lambda\begin{vmatrix} a+d+f & f \\ f & b+c+f \end{vmatrix} \quad (10)$$

Multiplying both sides of equation (4) by dt and integrating between the limits $t = T$ and $t = O$, where T is a period not less than four times the time constant of d or s, there follows:

$$\Delta\int_o^T z\,dt = A\int_o^T d\,t + B\int_o^X d\,x + C\int_o^Y d\,y - D\int_o^Q dq - E\int_o^O dz \quad (11)$$

The integral on the left hand is zero by adjustment being the total quantity passed through the galvanometer for one semi-period of the secohmmeter.

A is identically zero, having $ac = bd$

The integral of the B term is X the steady ultimate value of current x.

The integral of the C term is Y the steady ultimate value of current y.

The integral of the D term is Q the ultimate charge of the condenser $= k\,b\,Y$.

The integral of the E term is also zero by adjustment. So that $B\,X + C\,Y - D\,b\,Y\,k = o$; (12)

but $y = \frac{a\,x}{b}$ $\therefore B\,b + a\,C = D\,a\,b\,k.$ (13).

Solving the determinants and simplifying, there results

$$l\,b \pm \mu(a+b) = a\,b\,c\,k; \quad (14)$$

whence $\mu = \pm\frac{n}{n+1}(b\,d\,k - l),$ (15)

that sign of l being adopted which makes μ positive.

Small Induction Coil: Length, 11 cms.; External Diameter, 3.8 cms.; Primary Coil, 130 ω res.; Secondary, 435 ω.

Bridge.	Position of coil in cct.		Resistance	Capacity.	Self-inductance.		Mutual inductance.		Mean.
Ratio b : a.	Primary.	Secondary.	Observed ohms.	Adjusted microf'r'ds	Quadrants	Kilomet'rs	Quadrants	Kilomet'rs	Kilomet'rs
1000-100	In arm d.	Out of circuit.	129 35	0.370	0.0479	479			
	Out of circuit.	In arm d.	436.5	0.248	0.1083	1083			
	In battery cct.	" " "	436.5	0.088			0.0636	636	630
	" " reversed.	" " "	436.55	0.405			0.0623	623	
	In arm d.	In battery cct.	129.62	0 905			0.0631	631	
Another Coil 10.8 cms. long; 6.2 cms. External Diameter; Primary, 167 ω; Secondary, 3,300.									
1000-100	In arm d.	Out of circuit.	167.1	0.410	0.0685	685			
1000-1000	Out of circuit.	In arm d.	3305.	0.492	1.626	16260			
"	In battery cct.	" " "	3307.2	0.330			0.2675	2675	2660
"	" " "	" " reversed.	3307.8	0.651			0.2640	2640	
"	" " reversed.	" " "	3307.9	0.326			0.2735	2735	
"	" " "	" " as at first.	3308.7	0.648			0.2590	2590	
1000-100	In arm d.	In battery cct.	167.3	2 170			0.2680	2680	2680
"	" " reversed.	" " reversed.	167.5	2.170			0 2680	2680	

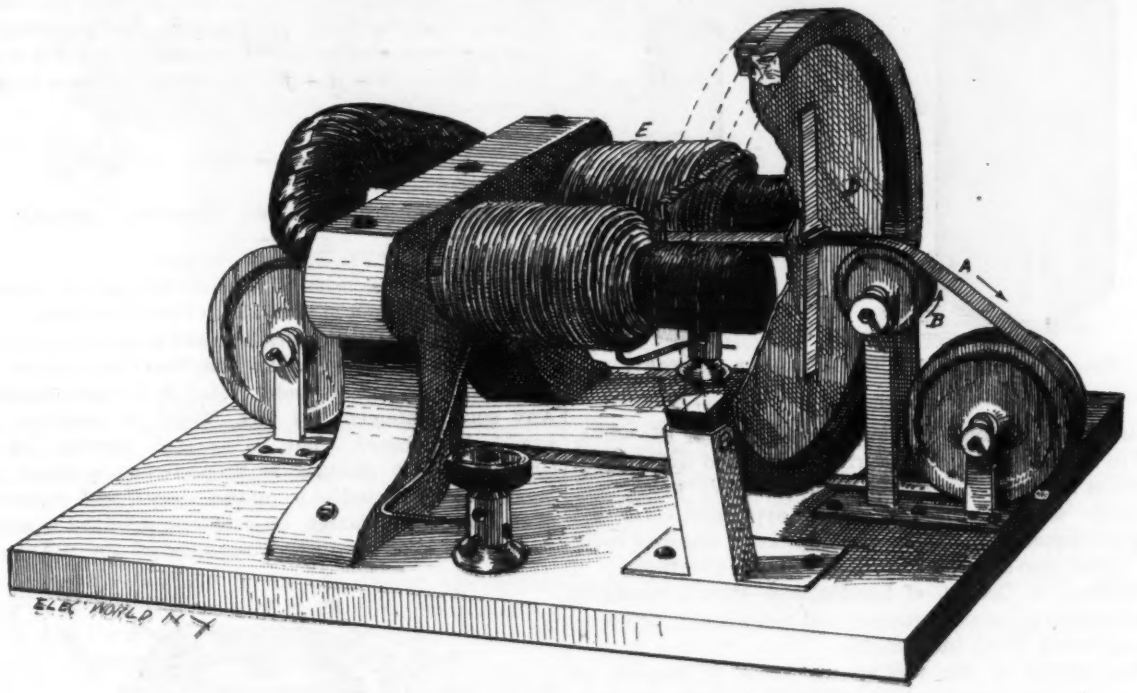
Electricity at the Paris Exposition.

(From Our Special Correspondent.)

PARIS, France, Sept. 1, 1889.

The readers of THE ELECTRICAL WORLD are already pretty well informed of the principal electrical exhibits at the Paris Exposition. While these exhibits, as a whole, offer quite an interesting field for study and comparison, they cannot, with one or two exceptions, be said to present any very striking novelty, at least to those who have closely followed the course of events in electricity of late years. The exhibitors are, of course, in the large majority French. but without making any comparisons, I think it can be truthfully said that in those departments in which foreign countries have exhibited alongside of the French, the former do not by any means suffer by comparison. Indeed, the contrary seems to be the case, some of the foreign exhibits being far superior to those of the French, not only in design of apparatus, but in actual method of construction. As stated above, your columns have already contained much that is of interest here, but there remain a few things with which your readers may not be acquainted.

Beginning with the American exhibitors, I need not enter into details of the large exhibit of Edison, which is already known to your readers. The Thomson-Houston Company have a very fine exhibit in Machinery Hall, including various types of their alternating machines, showing various systems, such as the compensating street lighting system and a compound alternating machine. This latter machine is remarkable for the manner in which the load can be thrown on and off without affecting the potential in the least. Then at the other side of this exhibit are



A NOVEL EXPERIMENT WITH THE ALTERNATING CURRENT.

shown various forms of machines of the Thomson Welding Company, and as is the case wherever this machine is shown in operation, it creates a sensation, crowds witnessing its operation every day Mr. A. S. Garfield, the son of the secretary of the Thomson-Houston Electric Company. has charge of the welding machinery. Mr. F. G. Parsons has the general electrical exhibit in charge, and Mr. L. Thurnauer gives valuable assistance occasionally to aid in explaining the apparatus, when his other duties in connection with the Thomson-Houston International Electric Company permit it. Mr. J. F. Meech, the manager of the Thomson-Houston Electric Company in Europe, is often about to look after the interests of his company.

Prof. Thomson's private exhibit is situated in the space devoted to the United States in the Industrial Section. You have, in your issue of Aug. 24, given a very good description of the remarkable experiments caused by the repulsion and the reaction of currents alternating in contiguous conductors, and a number of special meetings of scientific societies have been held around this exhibit in order to demonstrate these actions before them. President Carnot has already paid them a special visit, and I understand now that Sir William Thomson has spoken so highly of them to Madame Carnot, the President's wife, that she will also shortly pay a special visit to witness them. It is rather unfortunate for the public that the building in which this exhibit is placed is closed to the public at night; and on Sundays all the Americans, in true Puritan fashion, refuse to lift the curtains from their exhibits, and stay home ostensibly to rest. I notice, however, that they usually look very tired Monday morning. There are still some things in the private exhibit of Prof. Thomson which are worthy of description. Thus there is an apparatus shown which puts in motion a steel tape by the vibration of a diaphragm. I send you a drawing herewith, the diaphragm being partly broken away. A horseshoe shaped electro-magnet *E* is supported horizontally in front of an upright metallic diaphragm placed about one-eighth of an inch from the poles. And endless iron tape *A* passes through a small hole in the centre of the diaphragm *D* and between two jaws attached to the same, and thence over guide wheels. When an alternating current is passed through the coil it produces a vibration of the diaphragm, which, being communicated to the jaws, forces the tape outward through the diaphragm. While the tape passes over the pulley nearest the diaphragm in one direction, the pulley *B*, curiously enough, revolves in a direction opposite to what it would under ordinary circumstances. This very curious phenomenon has not yet been satisfactorily explained, but is no doubt due to the results of compound vibrations in the apparatus. Another apparatus shown is an electrostatic voltmeter, by means of which this type of instrument, as constructed by Sir William Thomson, may be used for measuring low potential. When used for alternating currents, the potential is increased by means of an induction coil, and for measuring direct currents, by an apparatus for charging in multiple a set of forty-eight condensers and discharging them in series into the voltmeter.

Another apparatus shown is a vacuum cut-out for arc lamps. In this little apparatus, when the potential is raised by the lengthening of the arc, enough of the current passes between a pair of contiguous carbons in a vacuum tube to energize an electro-magnet, the armature of which then makes a contact, cutting out the magnet which holds the carbons apart until the shortening of the arc decreases the potential.

Another interesting device shown is the repulsion action regulator employed in the alternating current arc lamps, which are shown in operation. This consists of a frame of laminated iron with two contiguous pole pieces around which are wound coils of wire resistance. A square copper plate hangs between the poles, and is attached loosely to a lever pivoted to a standard. The other end of the lever supports a clock-work arrangement for lowering the positive carbon. When the arc becomes too long, a strong current passes through this electro-magnet, which is in shunt with the carbons, and forces the copper plate upward. This motion disengages the clock-work and allows the carbon to descend.

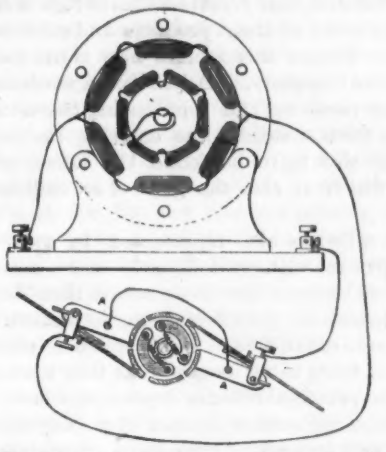
There is also shown here a model of an armature ring core constructed by Professor Thomson with the object of permitting the coils to be placed on the core ready wound. It consists of a laminated ring with a single removable segment, which can be taken out so as to allow the coil to be slipped on and the iron segment then re-inserted.

There is also shown here a unipolar dynamo, which is in reality two machines mounted on the same frame. The discs are placed opposite each other, and run in opposite directions, by which the distortion of the lines of force is prevented. Here also can be seen the instruments for demonstrating optically the phases of the alternating current, as produced in alternating machines for instance. Unfortunately these instruments were broken during transportation so that these beautiful experiments cannot be seen in operation. Your readers are, however, already acquainted with them, they having been described in THE ELECTRICAL WORLD.

Besides this there are a large number of other interesting things shown. One of these is an alternating current motor which is started with the brushes in contact with the commutator, but when the motor has attained its proper speed the brushes are removed from the commutator and the machine then runs as a simple induction motor.

It is a multipolar machine, the field magnets consisting of six coils which are wound in opposite directions and fixed inside a laminated frame. The armature also consist of six similar coils attached to the outside of an iron disc core.

A little mechanical assistance has to be given to the motor to start it, but it quickly gets up to its normal speed, about 1,500, the brushes being meanwhile shifted till all sparking is avoided. Once, however, it has got into the same phase as the dynamo which is supplying it with current, the brushes are rocked backward until they touch the contacts *A A*, which immediately short circuits the brushes and lifts them off the commutator, thus cutting the armature completely out of circuit. The motor then continues to rotate by induction from its field. An arrangement is attached to the motor shaft to short circuit

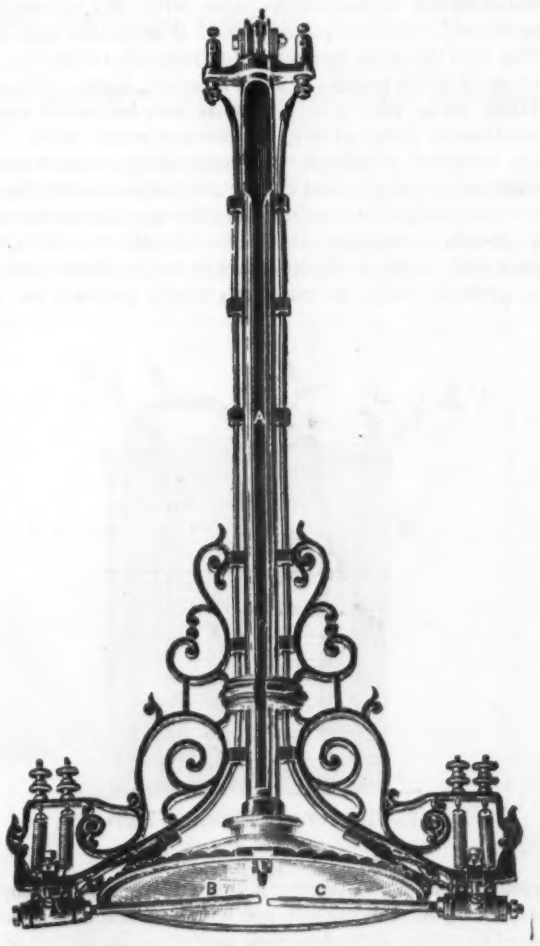


THE THOMSON ALTERNATING CURRENT MOTOR.

automatically the armature when the motor is in phase. Two semi-circular segments, which will be noticed inside the commutator, fly outward by centrifugal force and abut against the commutator segments, thus short circuiting them when the right speed is attained.

Among the other apparatus shown, there is a miniature incandescent shunt dynamo which does not weigh more than two pounds, and lights two little incandescent lamps, all placed under a glass shade.

There is also shown the Thomson lightning arrester for the main wire alternating circuits, the standard motor type arrester, and also the direct incandescent. In the old style of arc arrester the main current was usually passed continuously through the lightning arrester coil, energizing it so that it would blow out any arc formed between the plate. As this would be rather wasteful in a constant potential system, the new arresters are so constructed that the magnets are only energized when the arc is formed, thus avoiding the constant loss due to the charging of the electro-magnet. There are also shown several forms of the Thomson watt-hour meter, and a large number of other details of the Thomson-Houston system of electric lighting, nearly all of which are based on some interesting fact.



THE PIEPER ARC-INCANDESCENT LAMP.

As I have remarked above, hours could be spent in examining this exhibit alone, and so well were the jury pleased with what they saw that they invited Professor Thomson to breakfast with them during his visit to Paris, an honor which I understand was accorded to no other electrical exhibitor in the exhibition.

Directly opposite this exhibit is that of the American Bell Telephone Company, which is fairly said to be the most ornamental of the American electrical exhibits. Besides its beauty, however, it contains many interesting things in the field of telephony, together with the products of the Western Electric Company in general. I shall have occasion to

say more of this exhibit at some future time, and may here remark that it is well looked after by Mr. Bishop.

Grouped closely around these are the exhibits of the C. & C. Electric Motor Company, that of the Elektron Manufacturing Company, who show the Perret motors, the Okonite Company and the Cobb Vulcanite Wire Company, whose products your readers are well acquainted with.

The Mackay-Bennett Cable Company show a cable installation in working order with the Cuttriss recorder.

Messrs. Hanson, Van Winkle & Co., of New York, also exhibit photographs of their products and electro-depositing processes. Within this section also is the exhibit of the Graphophone Company. A half dozen machines are kept busy all day receiving and reproducing the voices of thousands, who form a steady line entering the pavilion. In this section also is to be found the Edison phonograph pavilion, which is also the goal of an endless stream of visitors.

Electric railways are represented by two Thomson-Houston trucks with switchboards and accessories, and the Sprague Company also show one of their double motor trucks in operation, the wheels being in motion.

The dynamo exhibits are considerable in number, quite a number of firms being engaged in that work in France, which is the principal country represented here. The first exhibit which one strikes is that of the Oerlikon Machine Works, of Switzerland, They show a large four-pole machine of 150 h. p., and a variety of other types which have already been fully described in THE ELECTRICAL WORLD. This is one of the most substantial exhibits in the whole exhibition, and every one who has seen it concedes the superiority both in design and beauty of the machines.

Directly in the centre of the Machinery Hall is the fine exhibit of Sautter-Lemonnier Company, which represents a lighthouse, around the base of which are grouped the various products of the firm. These consist of various forms of dynamos, machines, and a remarkably complete outfit of marine projectors and military electric field wagons, containing a boiler, engine, dynamo and projectors mounted on a single truck. At the top of the lighthouse there is shown a revolving lantern such as used in the regular service.

The Compagnie Electrique, of Brussels, exhibit a Julien electric railway truck in movement, with the power transmitted by means of steel chain. They also exhibit various types of Julien accumulators, both with flat plates and cone-shaped, with the point turned downward, one cone fitting into the other but separated from its neighbors.

Close by is the exhibit of H. Pieper, of Liege. The most striking thing shown here is what may be called a semi-incandescent lamp, giving a beautiful white light. This lamp contains practically no mechanism whatever, and consists of two horizontal copper rods separated for the distance of one-eighth of an inch, as shown in the accompanying sketch. Directly above the break in these two copper rods there is placed a carbon rod, which closes the gap between them by making contact between the two

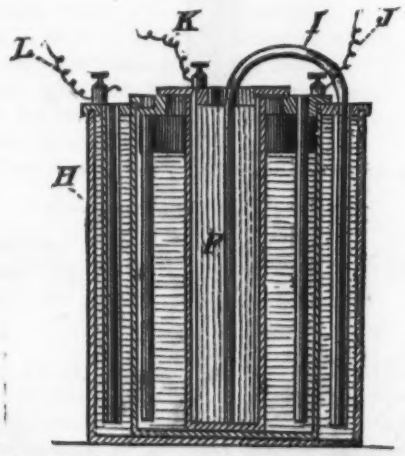


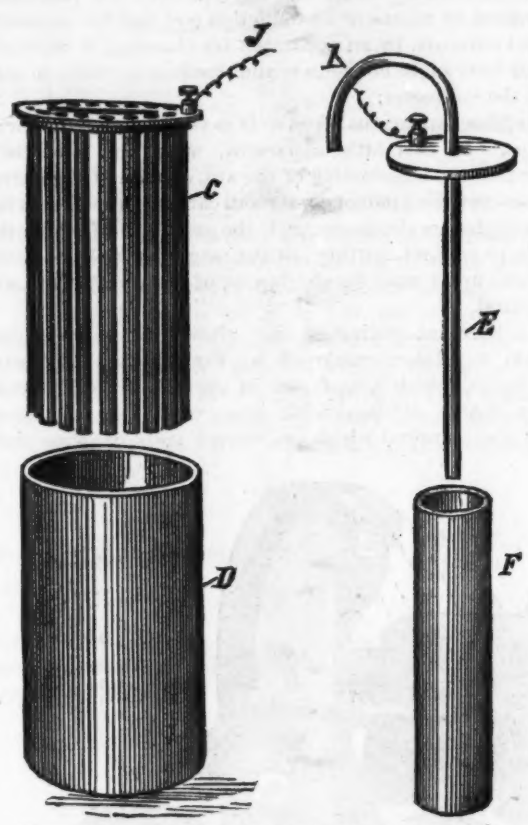
FIG. 1.—THE CROSS PRIMARY BATTERY.

copper ends. Upon passing a current through the copper rod, the tip of the carbon rod which closes the break is heated to white incandescence and gives the effect of an arc light of great steadiness. With 20 to 25 ampères and 8 to 12 volts the lamp gives 200 c. p. As the carbon tip is consumed the rod to which it is attached falls of its own weight, so that no regulating mechanism is required. The operation of the lamp seems to be most satisfactory, and I think that it will find considerable application for interior lighting where a more powerful light is required than is ordinarily furnished by incandescent lamps, and where the ordinary 1,200 or 2,000-candle lamp is more than is required.

The Sperry Electric Company, of Chicago, have a very nice little exhibit in charge of Mr. John F. Kingwill. They show one of their 12-light arc machines having the new magnetic regulator on it, by which any number of lamps can be cut out without causing a variation of the current. Within this space is also shown the Sperry mining machine, exhibited by the Sperry Mining Company, and with which your readers are also acquainted.

The Heisler Electric Company, of St. Louis, show one of their machines for long-distance street lighting in operation, feeding a number of circuits from the same machine. Connected up with the machine is their new regulator, which was illustrated in THE ELECTRICAL WORLD of August 24.

In the English Section, Messrs. Crompton & Co. have five incandescent machines in operation. These are of their well-known type with wrought iron used exclusively in the magnetic circuit. The fields and armatures of these machines are wound with square wire. They also show a novel device for avoiding the generation of Foucault currents in the heavy wires for machines designed for heavy current weight. Solid wires when used for this purpose, it is well known, heat up from this cause. To avoid it Messrs. Crompton & Co. build up a square conductor of, say, four or nine square wires, bundled and laid lengthwise. These are then given a half twist at the



FIGS. 2 AND 3.—THE CROSS PRIMARY BATTERY.

centre so as to change the relative position of the wires, and in this way the noxious currents generated are avoided.

Elliott Bros., of London, also have a very pretty and complete display of their electrical apparatus, consisting of galvanometers, rheostats, discharge keys, standard coils, etc. They also show various electrical ship telegraphs.

Paterson & Cooper, of London, also show a variety of galvanometers, ampère meters and voltmeters, including the Ayrton & Perry instruments.

The exhibit of the well known house of Breguet, of Paris, is most complete, and although they do not show anything particularly striking and novel, the variety of the work done by one house is very characteristic of the details into which the French often go. Thus there is a large exhibit to begin with of dynamos of various types. Prominent among these is the Desroziers multipolar machine, already described in THE ELECTRICAL WORLD, which contains no iron in the armature. The wires of the armatures revolve directly between the poles of the field magnets, which are brought very close together. I was not able to obtain the weights of these machines, but, judging from their construction, they would hardly be economical of copper, there appearing to be a great deal of dead wire on the armature. Besides, I should not consider the machine one which could be easily constructed, and, as one of your contributors once put it, I should hate to wind one of these armatures "on a quiet Sunday afternoon." The Maison Breguet also show machines of the Gramme type, and a large variety of measuring apparatus, telephones, telegraph and electric lighting accessories, electro-medical apparatus, electric clocks, block signal systems and the like.

Among the storage battery exhibitors are Messrs. Philippart Bros., who show the Faure-Sellon-Volckmar accumulators, of the type already illustrated in THE ELECTRICAL WORLD, in which the opposite plates of contiguous batteries are connected directly by the lead band without the intervention of a joint.

Close to this exhibit is that of the late M. Planté, which contains a number of the results of his numerous experiments, especially on the etching of glass by electric discharges. There are here also shown, rolled out for inspection, two plates of a storage battery made in 1860, which exhibits the peroxide plate entirely converted, leaving no trace of the original lead of which it was formed. By the way, it is interesting to note that this peroxide plate is marked + (plus) by M. Planté and the reduced plate — (minus). It was a pity that during the debate on the appellation of storage plates, which took place in the Congress, this fact was not recalled. Happily the Congress decided in the same way as M. Planté used to designate his plates, but this additional mute testimony to the correctness of the term is interesting.

WETZLER.

The Cross Primary Battery.

Eben D. Cross, M. D., of Chicago, was granted letters patent last February, covering certain features in a new form of galvanic cell designed for use in the lighting of residences, the operation of small motors, etc., and which has attracted some local attention. The elements employed are as usual, zinc and carbon, and a sectional view of the cell is presented in Fig. 1, showing three separate containers, the outer of heavy glass, the inner two of porous clay baked to a special hardness. Within the glass cell is placed the negative element of twenty-two hollow and slotted carbon tubes nine-sixteenths of an inch in diameter attached to a circular carbon disc on top and arranged as shown in Fig. 2. The large porous cup *D* holds the positive element "*C*," consisting of 21 zinc rods, one-fourth inch in diameter, attached by machine screws to a metal plate. The inner porous cup *F*, Fig. 3, contains an additional negative element, consisting of a single hollow slotted carbon tube *E*, attached to which is a soft rubber tubing that passes through the carbon disc and is employed in conveying the fumes generated within the glass jar to the same porous cup, which contains only water. Fig. 4 is a perspective view of the battery. The glass jar holds a solution of nitrate of ammonium and nitric acid; the middle porous cup, a solution of one part sulphuric acid to twelve parts water. The hollow slotted carbons *G* are lined with an asbestos material of high absorbent qualities, with a view of preventing the coating of the inner surface of the carbon with either a film of hydrogen bubbles or a deposition of zinc sulphate, and thus doing away with the possibility of polarization.

Although a battery composed of some thirty cells has been in operation during the last four months, Dr. Cross is not yet prepared to furnish any reliable data regarding the exact results accomplished with his battery, but will shortly publish the result of a series of tests undertaken to prove the commercial value of his cell.

A Letter from the New American Company.

To the Editors of The Electrical World:

Our attention has been called to a letter signed James J. Wood and published in your issue of the 31st ultimo.

Mr. Wood's letter is misleading, and probably intended to be so. A casual reader would infer that this company had no rights to the patents under which it is now operating. Any such statement by Mr. Wood or anybody else would be absurd, but a careful reading of his letter does not disclose so preposterous a claim. Mr. Wood has been mindful to protect himself and your paper from a libel suit, though he evidently intended to mislead the users and prospective customers of the "American

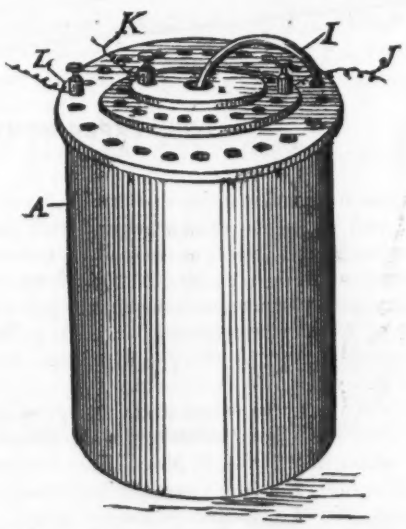


FIG. 4.—THE CROSS PRIMARY BATTERY.

system." Mr. Wood makes an ambiguous statement about "recent and important inventions" by himself since leaving the employ of the American Electric Manufacturing Company.

We know nothing of any "recent and important inventions" by Mr. Wood, and if he has "recently" invented anything of value, the undersigned and the public have yet to be informed of the fact.

The justly celebrated "American system," and all the patents and inventions connected therewith, are now owned and controlled by the New American Electrical Arc Light Company, and any interference with the same on the part of Mr. Wood or any of his friends in the Thomson-Houston and Fort Wayne Electric Light companies will be promptly dealt with as the law prescribes.

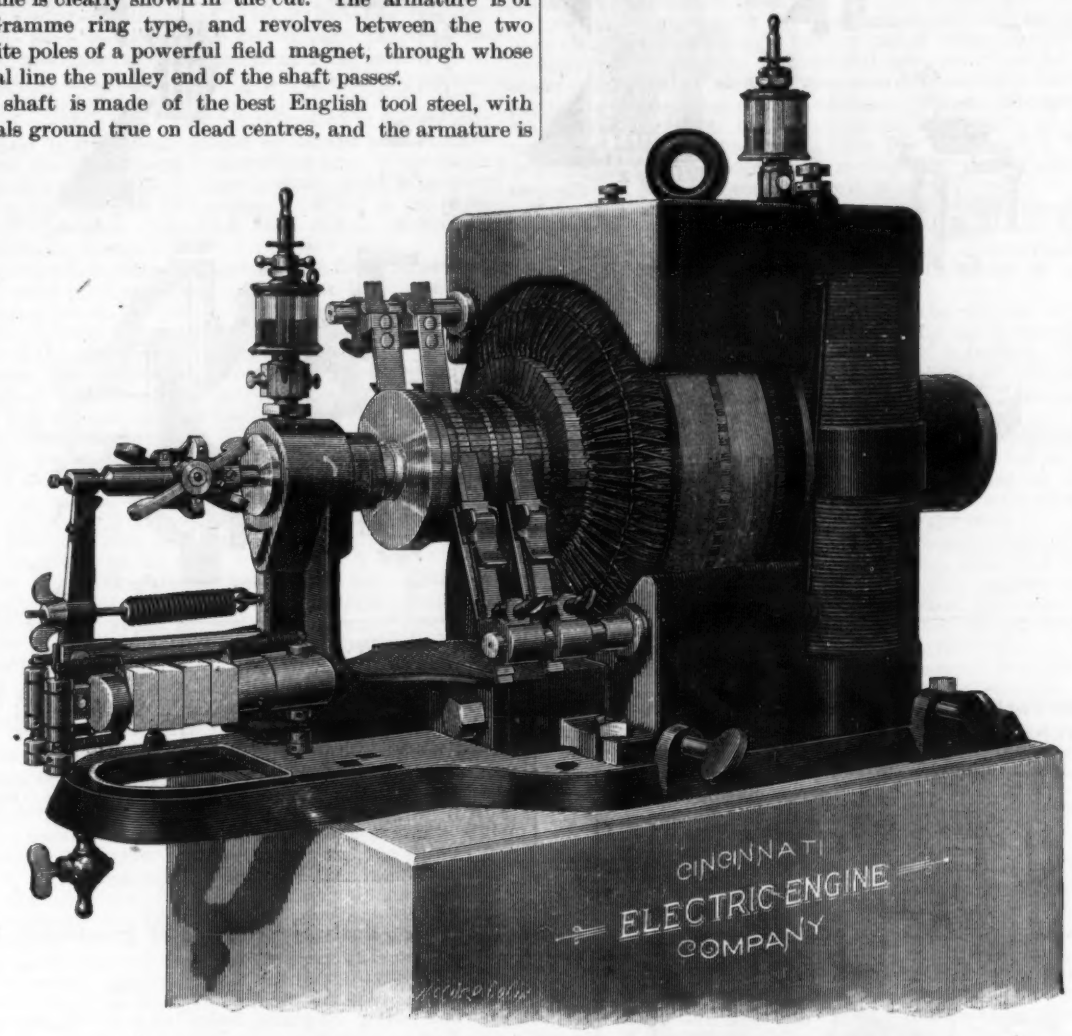
Mr. Wood is but a mouthpiece in this matter for discomfited rivals who failed to get control of our system which gives a better and cheaper light than their own. They may continue to talk through Mr. Wood, of "recent and important inventions," but we shall go on making new friends for the "American System," and holding fast to the old.

THE NEW AMERICAN ELECTRICAL ARC LIGHT COMPANY.
CHAS. E. WEST, Treas. and Genl. Manager.
18 Cortlandt Street, New York City.

The New Arc Motor of the Cincinnati Electric Engine Company.

We illustrate on this page a new motor recently designed for running on the arc circuit. The construction of the machine is clearly shown in the cut. The armature is of the Gramme ring type, and revolves between the two opposite poles of a powerful field magnet, through whose neutral line the pulley end of the shaft passes.

The shaft is made of the best English tool steel, with journals ground true on dead centres, and the armature is



MOTOR OF THE CINCINNATI ELECTRIC ENGINE COMPANY.

so attached as to practically constitute a portion of it, avoiding all danger of loosening, a point of no mean importance in this class of machinery. Ball bearings are used, admitting of self-alignment. They are made of phosphor bronze, hand-reamed, and of considerable length, to give an even bearing surface and prevent all tendency to heat, and are kept at all times thoroughly lubricated. The commutator sections are of drop forged copper, thus being hard and of almost pure metal. The commutator is attached to the armature in a novel manner, and can be renewed without disturbing the armature wires.

The armature is accurately adjusted to a running balance and provided with means for forced ventilation. The ordinary rocker arm supporting the brush holder has been dispensed with, thus rendering the important parts more readily accessible.

The governor, the construction of which is shown in the figure, maintains the speed constant under all variations of load from zero to the full designed load of the machine, and is remarkably simple. It has but one wearing point. It regulates solely by variation of pressure, practically eliminating motion and wear. hence its great durability and sensitiveness.

The motor shown is of a maximum capacity of 2 h. p., and occupies a space of 10 by 19 inches, with a height of 12 inches, and is of very high efficiency.

The motors for constant potential circuits are similar in design, but do not require any governor, as they regulate automatically. These machines are manufactured by the Cincinnati Electric Engine Company, Cincinnati, O.

The Report of the Commissioner of Patents for the Fiscal Year 1888–1889.

BY WILLIAM A. ROSENBAUM.

The report of Mr. C. E. Mitchell, the Commissioner of Patents, to the Secretary of the Interior for the year ended June 30, 1889, shows a marked increase of business over the previous year. The total number of applications filed including reissues, designs, trade-marks and labels, was 39,702. This is an increase of 1,933 over the previous year. The receipts of the office above expenditures amounted to $186,859.98. This amount is $17,595.29 in excess of the profits of the previous year, which, added to the amount already amassed, makes a grand total of $3,524,526.63 deposited in the Treasury of the United States as the profits of the Patent Office.

For the past three or four administrations each commissioner in his annual report to Congress has urgently requested that provision be made for an increase of force in the Patent Office and for more space, in order that the work of the office might be carried on with greater facility and more comfort to the employés. It appears strange, indeed, that it should be necessary to make this request of Congress more than once, when it is known that this large amount of money is lying in the Treasury to the credit of the Patent Office. It seems to me that the rational way to dispose of this portion of the "surplus," and to prevent any large accumulation in the future, is to erect a suitable building for the accommodation of the Patent Office with the funds now on hand, provide it with respectable shops, laboratories and apparatus for experimental purposes, and, in fact, make it as complete and perfect as possible for carrying out the important work of the office. Then increase the force, increase the salaries of the principal examiners, and finally reduce the government fees for the examination of an application and the issue of the patent from thirty-five to twenty dollars or thereabouts. Until this more liberal plan is in operation inventors will have cause for complaint. It is a practical impossibility for satisfactory work to be done under such conditions as those pointed out by the commissioner. He states that in one instance nine men and women are working in a room only 9 × 23 feet, containing nine desks and the necessary number of book and file cases. In another room, 20 × 35 feet, there are ten clerks and as many desks and cases. These instances differ only slightly in degree from nearly all the rooms occupied by the office. The two highly important electrical divisions are confined in rooms no larger than those above mentioned.

The report goes on to say that the work of the office is satisfactory as compared with that of former years. The examination of applications for patents carried on in twenty-four of the thirty examining divisions has been brought up to within two months of date, and of the remaining six divisions one-half are less than three months in arrears. Electrical division A, which conducts the examination of applications relating to lighting, telegraphy, telephony, and signaling, is about four weeks behind in its work, while division B having generation, distribution and motive power applications is about five weeks in arrears. These divisions may be regarded as practically up to date, as there is a certain amount of miscellaneous and routine work which necessitates a few weeks' delay in the examination of new cases. The electrical divisions together handle about three thousand applications for patents, of which number about fifteen hundred are actually issued.

The Commissioner touches upon the need of legislation amendatory of the Revised Statutes relating to patents Some of the provisions which should be altered are sections 4,885, relating to the date of patents; section 4,887, relating to the duration of patents for inventions previously patented in a foreign country, and section 4,936, relating to reimbursement of moneys paid by mistake into the Treasury. It would be wise also for Congress to require the Federal Courts to furnish copies of all decisions and opinions in patent causes for publication in the *Official Gazette*, in order that the Patent Office in adjudicating upon questions arising in the granting of patents should conform more nearly to the decisions of the Federal courts. There can be no doubt of the correctness of such practice.

The following statement is extracted from the report of business for the year:

Received:	
Applications for patent	36,740
" " design patents	808
" " re ssue "	101
" " registration of trade marks	1,281
" " " " labels	772
Caveats	2,345
Total	42,047
Number of patents granted, including reissues and designs	21,518
Number of trade marks registered	1,111
" " labels "	312
Total	22,941
Receipts from all sources	$1,186,557.22
Expenditures (including printing and binding, stationery and contingent expenses)	999,697 24
Surplus	$186,859.98
Balance in the U. S. Treasury on account of the patent fund	$3,524,526.63
Number of applications awaiting action on the part of the office July 1, 1889	7,073

The Difference Between Primary and Secondary Batteries.

To the Editors of The Electrical World:

The last sentence in Dr. Trebel's note is as misleading as the quotation from Judge Coxe, to which I objected.

It has long been agreed that when a current is used to prepare, construct, build up, form or make a pair of electrodes, the pile in which they are used shall be called a secondary battery. But no current intervenes, nor are the electrodes subject to the action of any current afterward. There is no storage or accumulation of electricity in such arrangement, any more than there is inany galvanic cell. Nothing more has been done by the current than to form a pair of electrodes more widely apart in contact difference of potential.

Whenever a method of forming the electrodes without the aid of a current is discovered, then we will have a "primary battery pure and simple," and beyond cavil.

The terms "storage battery," "accumulators," are simply misnomers, and as misleading as Sir William Thomson's "box of electricity." There has been altogether too much of this in electric terminology.

D. FLANERY.

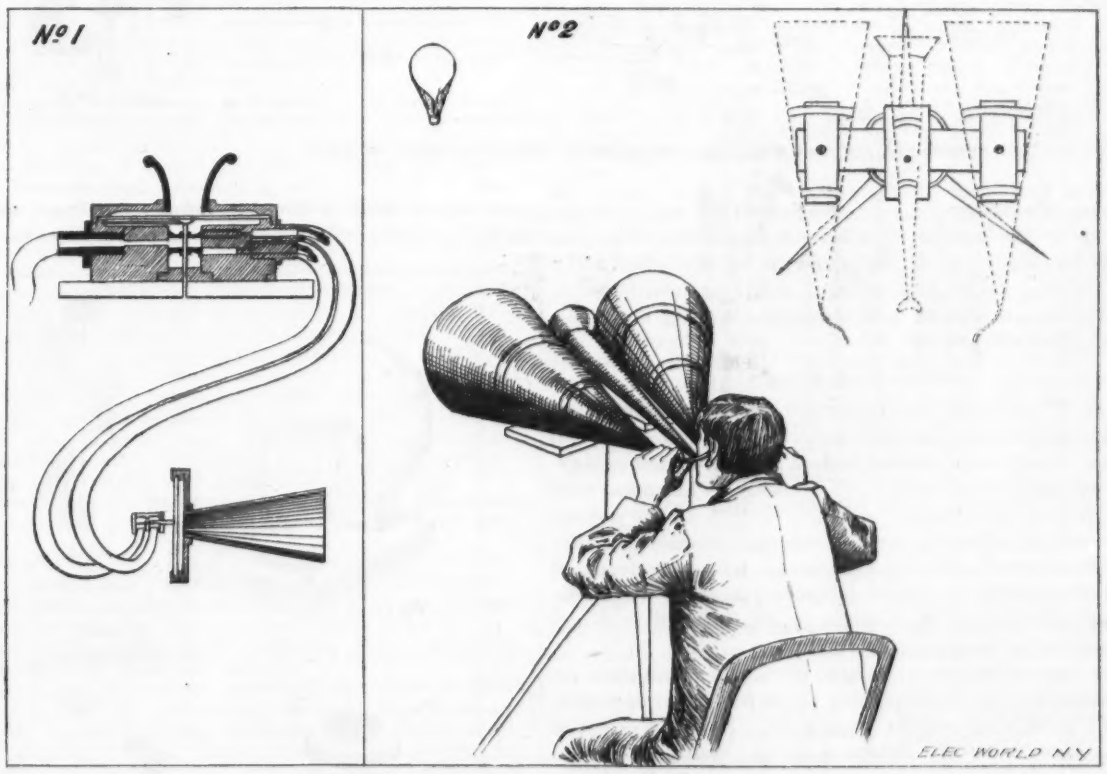


FIG. 31.—EDISON MEGAPHONE (See page 234).

Edison and His Inventions at the Paris Exposition.—VI.

BY W. J. HAMMER.

(*Copyright*, 1889.)

THE TELEPHONOGRAPH.

A combination of a telephone operated at a distant station with a phonograph, was shown in Fig. 9, diagram 3, which Mr. Edison terms his "telephonograph." The vibrating diaphragm of the ordinary phonograph mouthpiece is actuated by electro-magnetism produced by a current from a distant point, instead of by the direct sound waves or impulses from the throat, thus making a record at a distance which can be converted into sound when desired.

THE MEGAPHONE.

In his researches in sound, Mr. Edison constructed a remarkable simple and effective instrument for conversing at long range; it is shown in operation and diagrammatically in diagrams 3 and 4, Fig. 31. It consists of two huge funnels of paper, wood or metal over six feet in length, and tapering from a diameter about 2 feet 6 inches at the mouth, to a tiny aperture terminating in flexible ear tubes. These funnels, together with a wide-flaring speaking trumpet, are mounted on a tripod and compose the instrument. Conversation in an ordinary tone of voice has been carried on at a distance of two miles with the megaphone. A person walking through the grass, at a distance of several thousand feet, was plainly heard in the instrument (page 233).

THE AEROPHONE.

The aerophone shown in diagram (Fig. 31) is intended as a sound amplifier, its object being to increase loudness of spoken words without impairing the distinctness of the articulation. The magnified sound proceeds from a large diaphragm vibrated by steam or compressed air, which is controlled by the motion of a second diaphragm vibrating under the influence of the sound to be magnified. The component parts are the source of power, an instrument to control the power, and a diaphragm vibrating under the influence of the power.

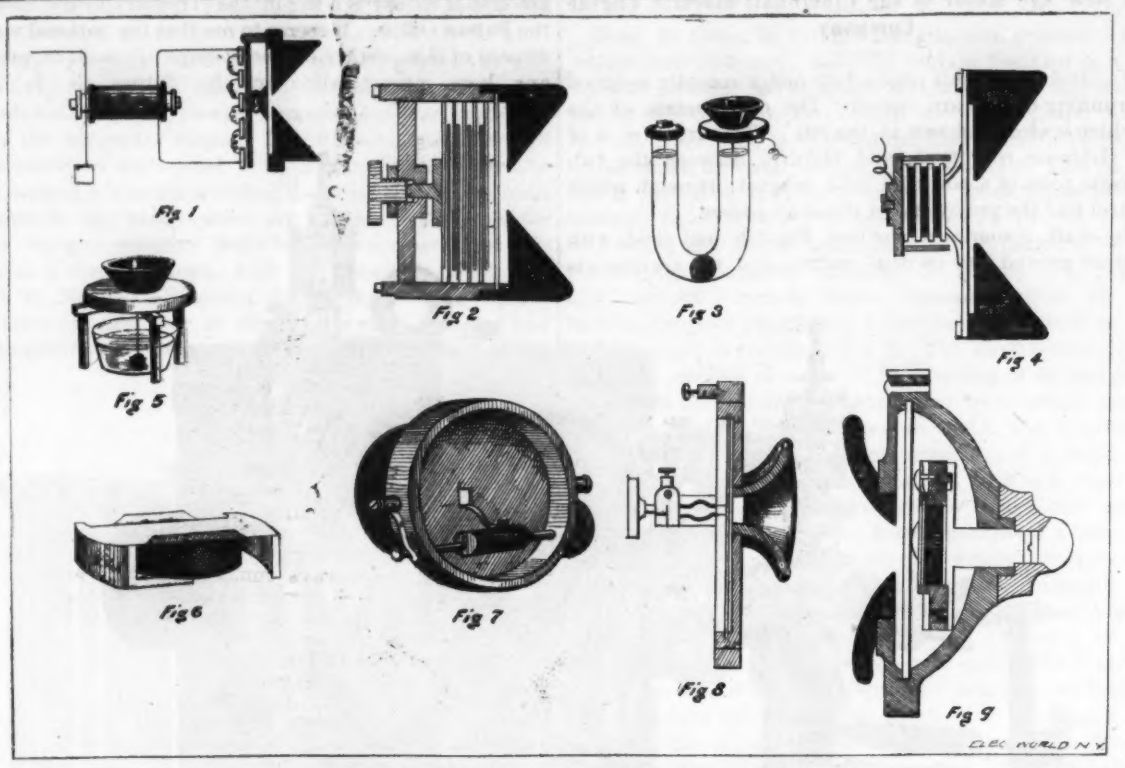


FIG. 33.—EDISON'S TELEPHONIC WORK.

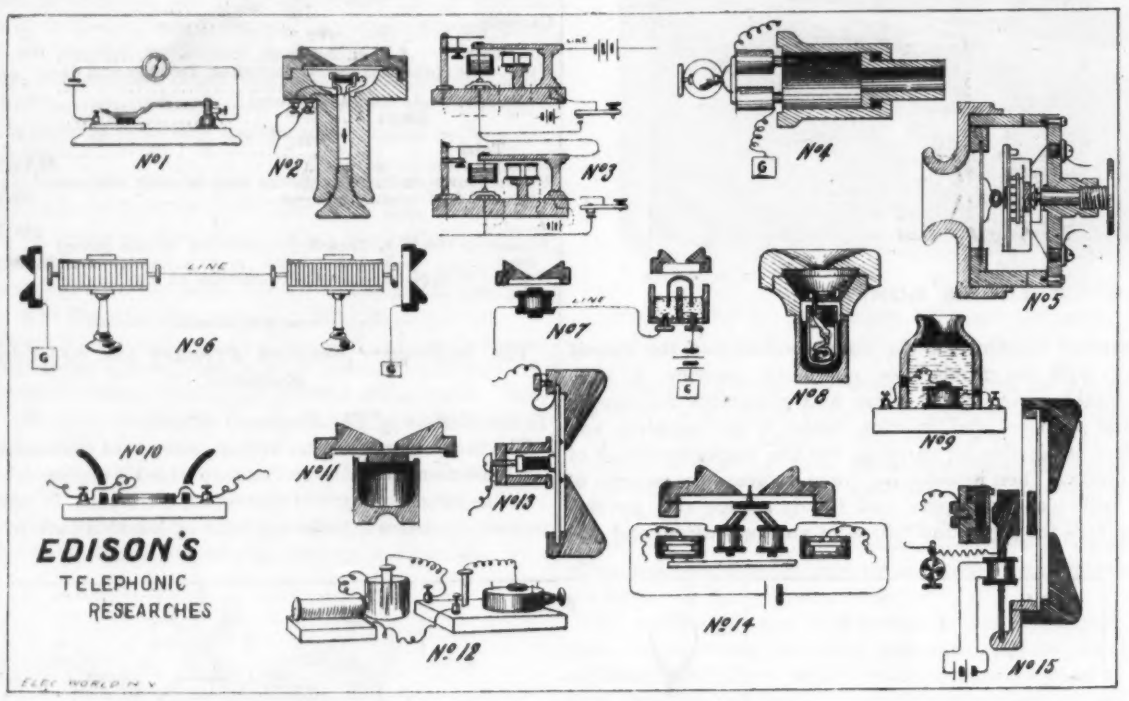


FIG. 32.—EDISON'S TELEPHONIC WORK.

THE TELEPHONE.

Figs. 32, 33 and 34 illustrate the enormous amount of experimental research in telephony which Mr. Edison carried on, an amount unparalleled both in originality and variety, and dating from his early work in multiplex harmonic telegraphy and his acoustic telegraph in 1875 to the present time, and including his water telephone, electrostatic telephone, condenser telephone, chemical telephone, forms of magneto telephone, inertia telephone, mercury telephone, voltaic pile telephone, musical transmitter, electromotograph receiver and carbon transmitter.

It is impossible here to go into the details of all these inventions, but the last two being by far the most important, it will be well to consider more fully. It is also essential to mention that to Mr. Edison is due the credit of first applying the induction coil to audible speech transmission, a factor, which, were it withdrawn to-day, would render practically inoperative the present method of speech transmission. Undoubtedly the most important contribution of Mr. Edison to the art of telephony is his carbon transmitter, shown in diagram 4, Fig. 8; the instrument in which millions of messages per day are spoken, although in the popular mind this instrument is better known as a Blake transmitter, owing to a modification of Blake's in the mechanical adjustment, and in no way altering the principle of Mr. Edison's wonderful discovery, which governs its operations, *i. e.*, the variation of the electrical resistance of carbon under pressure. This he first observed in 1873, during some experiments on rheostats for artificial cables in which he employed plumbago, carbon and other materials. In the Edison transmitter, in practice, the carbon is introduced in the primary circuit of an induction coil containing the battery, and the sound waves impinging upon the diaphragm vary the resistance of the carbon button, and consequently the resistance of the primary circuit, thus varying the flow of current from the battery, and producing a corresponding variation in currents on the main line by means of the induced currents set up in the secondary of the coil.

The principal of the variation of the resistance of carbon under pressure, Mr. Edison applied to a variety of other uses. Many of these were made prior to the invention of the telephone; some of these were shown in Fig. 8.

He also demonstrated that lamp black produced by the burning of any of the lighter hydrocarbons was by far the best substance, although amorphos phosphorous plumbago, hyperoxide of lead, oxide of copper, powdered gas retort carbon, black oxide of manganese, finely divided metals and many sulphides may be used.

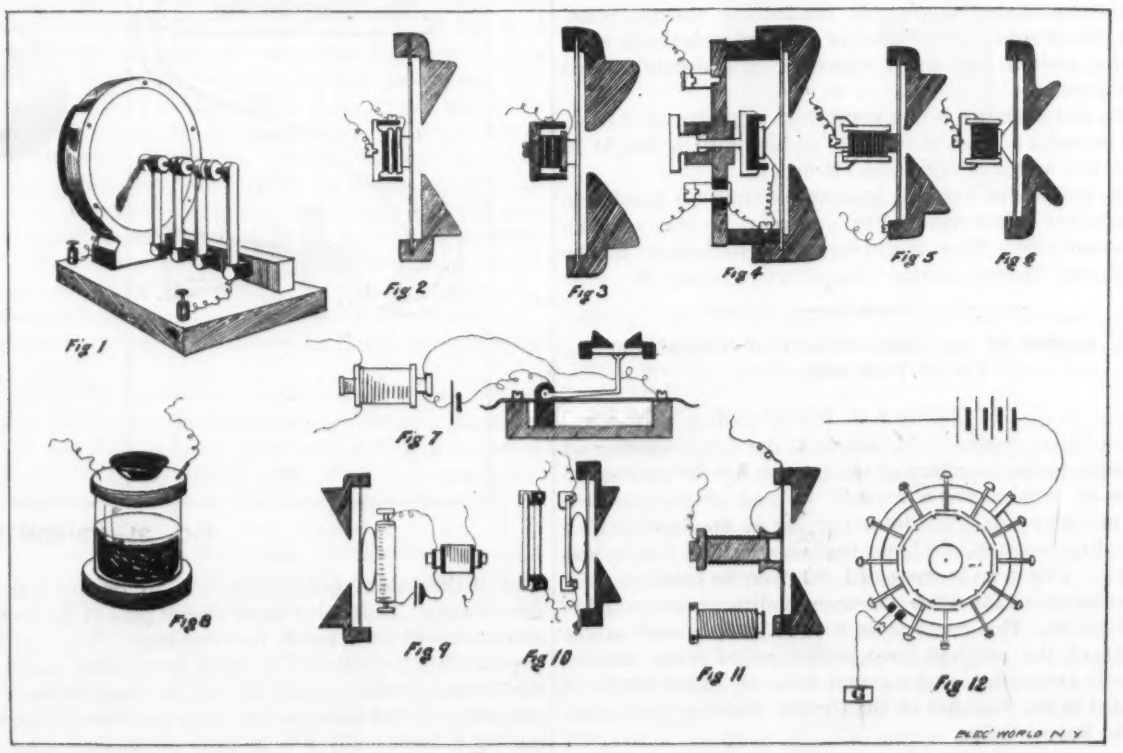


FIG. 34.—EDISON'S TELEPHONIC WORK.

The Street Railway Situation at Providence, R. I.

To the Editors of The Electrical World:

In your "New England Notes" of Sept. 28 you state, in paragraph under "Providence, R. I.," that the street horse car railroad here intended making experimental trials of several electric cars operated by storage batteries; that they depended upon the Electric Company to furnish the current for same to charge the batteries; that at the last moment they found it could not be done, and that a special dynamo had to be furnished for the purpose.

In simple justice to ourselves, who are the only electric company here, will you permit us, without the least reservation, to most emphatically deny these statements so far as we are concerned, and to request that you will publish this denial in full.

The only item of truth in the whole paragraph is that the horse car railroad intends having an experimental trial of electric cars—when they can get them. These cars, which were promised to be delivered so far back as May last, have not yet come, and it seems hard to know when they will actually be here.

We had made arrangements with the horse car railroad to supply them with electricity, and are now, and have all along been, ready to meet all the requirements necessary for their operation. The dynamo reference is just a flight of imagination of the paragraphist, as such information could only come from ourselves or Commander Bartlett, of the horse car railroad.

MARSDEN J. PERRY, Vice-President.

PROVIDENCE, R. I.

On the Present State of Traction by Storage Batteries.

BY DR. LOUIS BELL.

The possibility of profitably employing storage batteries for electric traction has been a most alluring one, and during the last ten years experiments have been continually in progress toward that end. Most of these experiments have been, for obvious reasons, private, and but few definite results have ever reached the public. Reports, indeed, have been tolerably numerous of late, but in most cases all details that could possibly give a basis for an estimate of the value of the system have been omitted. Every one now knows that a car can be propelled at a good rate of speed and up reasonable grades by means of a storage battery, but the questions to be answered are: What is the first cost and probable yearly depreciation of the batteries? What is the efficiency of the system? What is the probable cost of operation compared with horses, cables and other electrical systems?

These questions, perhaps, cannot now be fairly answered, but some recent publications give data far more valuable than anything previous; and a discussion of the general state of the problem at present is not untimely.

First, as to the efficiency of the system. It is clear from the start that the double transformation involved in the storage battery must involve a more or less serious loss of energy. The amount of this loss is easily measured in a given case; but, unfortunately, it is far from being a constant. On the contrary, it is an exasperatingly variable function of the charge and discharge rates and other minor factors. The main losses in a storage battery are due to heating, local action and electrolysis of solution, and these can never be eliminated and may be greatly increased by improper treatment of the cells.

Tested in the laboratory, at low charge and discharge rates, an efficiency of 85 to 90 per cent. is quite obtainable from most modern types of cell. But a heavy discharge rate greatly lowers the efficiency, and not only does this, but is very liable to injure the cell permanently. The same cell which gave 90 per cent. efficiency at a low discharge rate may give but 50 or 60 per cent. when discharged rapidly. There are no data available to show the efficiency of a storage battery under anywhere nearly the same conditions that exist in electric traction.

The experiments which have been made with rather heavy discharge rates seem to point to from 60 to 70 per cent. as the greatest efficiency that can be expected. But these experiments do not represent the case. In street car practice the discharge rate must be of the most variable kind, and the efficiency of a storage battery under a widely varying discharge rate has never to my knowledge been determined. It would not be sufficient to determine the amount of variation and then deduce a result from experiments at a constant discharge rate, for the effect of a heavy discharge will vary as the battery is freshly charged or partially run down.

Experiments on this subject are greatly needed. As to the efficiency of the other portions of the electrical plant information is easy to obtain.

The engine used for charging the batteries can be used rather more economically than in the electrical systems using direct supply, for it can be run, even if not under constant load, at least under one not subject to sudden and great variations.

The efficiency of the dynamo being the same in either case, and taking the friction of the engine at 10 per cent. of its rated full load, an estimate in accordance with good modern practice, the efficiency from steam to electricity at the charging station might be fairly taken at 75 per cent.

$$\frac{E.\ H.\ P.}{I.\ H.\ P.} = .75$$

The efficiency of the motors should be very nearly the same in either storage or direct systems, and for the motors in general use, the commercial efficiency, including friction of gearing, may perhaps be taken at 75 per cent., this figure being subject to so many varying conditions as to be rather uncertain.

Regarding the efficiency of the accumulators, I have shown that an accurate estimate cannot at present be made. At best it is very uncertain, but under the rather severe conditions imposed by traction work, I should much dislike to rely on a working efficiency greater than 70 per cent. from any accumulator with which I am acquainted.

We are now in a position to form a rough estimate of the probable efficiency of the storage battery system from indicated horse power at the engine to wheel horse power at the cars. Taking the above estimates, it will be:

$$\frac{W.\ H.\ P.}{I.\ H.\ P.} = .75 \times .75 \times .70 = 40 \text{ per cent. approximately.}$$

Comparing this figure with the direct supply systems, I find that Mr. G. W. Mansfield in his recent admirable paper agrees substantially with my own estimate of the obtainable working efficiency in this case, placing it at a little under 50 per cent. for ordinary cases.

If this comparison seems unfair to the storage battery, I can only reply that I am a believer in the ultimate success of the accumulator, and would hail with joy any authentic tests disproving the above estimate.

But there is yet another side to the efficiency question that deserves careful attention. In the storage system extra power must be furnished to drag around the nearly two tons of battery. In other words, the proportion of the power furnished which goes to doing useful work is much diminished.

In fact, with any system of motors whatever, it becomes necessary, if an idea of its real efficiency is to be obtained, to take into account the effect of its dead weight on the amount of power to be furnished. There may often be good economy in sacrificing theoretical efficiency to gain practical efficiency.

To obtain a proper basis for the comparison of various motor systems we must then take into account the proportion of total to useful work, and to do this I have found it convenient to combine the theoretical efficiency with the ratio of useful to total work as follows:

$$\text{Economic ratio} = \frac{\text{commercial efficiency} \times \text{useful weight}}{\text{Total weight}} = \frac{E\,L}{W}.$$

Writing E for the total commercial efficiency and L and W for the useful load and total weight respectively.

The above ratio gives a correct measure of the proportion of the power supplied to any motor system which is utilized in doing useful work. The reciprocal of the economic ratio will then be the amount of power that must be supplied to the system to do unit amount of useful work.

It measures the passenger-carrying power per horse-power furnished at the prime mover.

From the standpoint of the economic ratio it is possible to make a fair though necessarily approximate comparison between all sorts of motor systems, and to make this comparison on a common basis.

Now apply this say, to the comparison between an ordinary electric car, a storage battery car, a cable car and a locomotive. The total commercial efficiency should be taken as the ratio between the power generated at the prime mover and that exerted at the car wheel. The useful load should be taken in each case as the weight of the necessary car body and truck plus the weight of a full working load of passengers. It is clear that the car should be included, being a necessary load in each case.

Take first an ordinary electric car. A 16-foot Sprague car with two 7½ h. p. motors complete weighs about 6,400 pounds, of which about 2,400 is in motor apparatus and 4,000 in car. A full working load would be about 30 persons, estimated weight 4,000 pounds.

For a storage battery car I will take the figures of the new Julien car as far as possible. The car is stated to weigh complete 14,000 lbs., of which 3,800 is battery. The car has to be of unusual solidity, on account of the great weight of battery. It is a 16-ft. car, and has the same carrying capacity as the above.

The cable cars are always run in trains, consisting of grip and motor cars, both carrying passengers; but as the weight of the grip apparatus is negligible compared with the total weight, the system must be credited with an economic ratio equal to its efficiency, say 50 per cent.

In the case of a locomotive we may take the weight of engine at 80,000 pounds, tender (mean) 20,000 pounds, and train of, say, four ordinary coaches, Pullman and baggage car, aggregating about 90 tons. The commercial efficiency of the system is high; since we have only to deduct engine friction, amounting to about 10 per cent. probably.

These weights are only approximations, and in any special case of course the actual weights would be substituted.

They will, however, lead to a tolerably fair comparison, and will enable some conclusions to be drawn as to the nature of the variations in the economic ratio in different systems. Computing then $\frac{E\,L}{W}$ we have:

System.	Economic ratio $\frac{E\,L}{W}$	Power for unit useful work.
Direct electric	.385	2.62
Storage	.18	5.55
Cable	.50	2.00
Locomotive	.58	1.72

The economic ratio for the steam systems will increase decidedly with a heavier load, while for the electric roads it will increase, but more and more slowly as the electrical efficiency of the motors falls off. Where traffic justifies it, the use of a trailer is decidedly beneficial, evidently. The storage car seems needlessly heavy, and its economic ratio ought to be raised to .25. The car used in Antwerp would have given an economic ratio of .29, but it carried 1,200 pounds less storage battery than the New York car.

From the inability of a storage battery to stand very heavy discharge rates, the weight of battery per horse-power hour stored is quite large. From the figures given by the Julien Company as to its New York cars the battery has a capacity of 35 h. p. hours, and consequently weighs 108.6 pounds per h. p. hour.

It seems, at present impracticable to run a car successfully and furnish the power necessary for the exigencies of the service with less than 3,000–4,000 pounds of battery. Unless the cells are very much lightened intrinsically or made capable of standing a much higher discharge rate than at present, there seems to be little hope of reducing this battery weight to a reasonable figure.

Next, as to the life that can be reasonably expected from the cells. All sorts of figures are given, but the only ones that seem to represent the real experience gained in the practical operation of a road are those recently published from the Brussels road. According to the result of two years' running, the positive plates would have to be renewed every 200 days. The life of the negative plates would be much longer. An American report on another type of battery used in train lighting reported positive plates destroyed within a year, and very similar experience seems to have been derived from nearly all storage batteries—out of the makers' hands. Of course with expert care continually exercised better results can be obtained. This short life makes the expenses of renewal considerable, and but little comfort can be derived from the recent suggestion that the car companies would do well to reconstruct the positive plates from the disintegrated material. From a practical point of view this is about as feasible as rewinding their burnt out armatures and casting new trolley wheels out of the scraps of the old ones. No company of moderate size could profitably undertake this sort of work.

As to actual running expenses, the most complete figures are to be found in the Brussels report. The total expense for motive power, repairs, renewals, etc., was 8 cents per car mile—$4.80 per car day, the run being 60 car miles.

The cost of maintaining the batteries proved to be 2⅜ cents per car mile—$1.65 per car day.

The above cost of motive power was the same as with horses, while cost of plant, royalties and other expenses brought the cost of operating with electricity considerably above that with horses. The cost of motive power, as estimated by the accumulator company, was 6$\frac{4}{10}$ cents per car mile as the outside limit, while their estimate of maintenance of batteries was 1¼ cents per car mile.

The estimates of the Julien Company, in New York, give motive power at $3.40 per car day of 75 miles. It is to be hoped that the ratio between estimate and fact is more favorable than on the other side of the Atlantic.

By comparison with the systems of direct supply, it is evident that, owing to lower efficiency, the expenses in actual power for the same service will be considerably (50 per cent. or so) larger in the storage system. That much is assured by the lower commercial efficiency and increased weight. Then we have maintenance of batteries and motors, estimated by the Julien Company at $700 per car per year, as against maintenance of lines and motors in the direct supply system. The low figure on this would certainly be far below the above figure, particularly on roads of any size.

The comparison of the storage system with horse traction is not so easy. The Brussels figures are decidedly in favor of horses after two years' thorough trial. The track on that line, however, is not good, and the grades are higher than seem advisable with the storage system, there being one grade of 4 per cent. 1,500 feet long. American figures are not sufficiently definite as to details, and the favorable results have been obtained by an accumulator company's own expert care. All that can fairly be said is that it yet remains to be proved that the storage system can be operated as cheaply as horses. So long as we have to rely on the heavy and rather perishable lead accumulator, proof will be hard to obtain.

It seems to have been demonstrated that the storage system, economy aside, may be made thoroughly reliable in careful hands. The New York cars have an enviable record in this respect.

To sum up: The storage system has certain great merits which especially commend it for city work. It requires only a track; each car is an independent unit, and no accident can cripple the system. The service can be made thoroughly reliable.

Its economy is at present doubtful; it costs distinctly more than traction by direct supply and probably more than traction by horses, unless under specially favorable circumstances.

In any electric system, carefully laid track is necessary for success; but in the storage system it is doubly so, and steep grades are peculiarly undesirable. There is nothing more likely to hasten deterioration of batteries than the jolting due to a rough track and the heavy discharge rates necessary on a steep grade. For city work, with good level tracks, it is certainly an ideal method of traction.

In closing, let me say that I feel confident that the time will come when the storage battery will be the general method of traction wherever the overhead wires are objectionable, and specially in large cities. The time is not yet, however, and it is by no means certain that any of the present types of accumulator will share in the ultimate success of the system.

Electric Launches on the Thames.*

BY PROF. G. FORBES.

This paper on Electric Launches on the Thames has arisen out of the fact that during the past summer, while I was living down the river at Bray, I was enabled to have the opportunity of keeping one of those electric launches, which have been built by Messrs. Tagg lately, and electrically equipped by Messrs. Immisch. I thought it would be interesting to draw attention to one's experience in this connection. I speak not only from my own observations, but from those of every one who has used them on the river, and also the views of a very large number of those who have seen the performances of these boats and watched them, and who are habituated to the river, when I say that there is hardly the slightest doubt that in the course of a very few years the steam launch as a pleasure boat on the River Thames will be entirely abolished.

On the River Thames there are some special peculiarities which make the electric launch peculiarly suitable, and it by no means follows from what I have said, that in other cases the electric launch will be as speedily and universally adopted. Among the points worthy of notice are, in the first place, that launches on the river are required chiefly in summer, when the heat, smoke, smell, oil and dirt of a steam launch are objectionable; and also that, owing to the larger traffic, and to prevent injury to banks and boats which are tied to the banks on the river, it is impossible on the Thames to allow high speeds in launches. Hence a comparatively small supply of storage batteries or accumulators is required for driving the electric launches at the very moderate speeds which are permissible on the Thames.

It may also be added that on the Thames it is easy to secure a sufficient number of charging stations. At present there are four or five at easy distances apart. Eventually there can be little doubt that the hotels on the river will find it financially a good plan to be lighted electrically, and then this power which they have on the premises can be used during the night for charging the storage batteries of launches.

The house which I occupied was at Bray, just below Maidenhead, and each night I took the launch by myself, towing a boat behind, up to the charging station (which was not a mile away). I left it there to be charged during the night, and by breakfast time the launch was outside ready charged, with a sufficient supply to last me the whole day. I may mention that I never exhausted the complete charge of the batteries in my launch during the whole time. I generally went out shortly after breakfast, spent the whole day on the river, very often coming home at eight o'clock, and afterward taking it up to the charging station in the evening; and certainly forty miles was not by any means enough to exhaust the supply of electricity on the launch.

The management of the boat is extremely easy, the steering gear and everything about it being perfectly handy. There was no difficulty in crowded locks—going in and bringing up alongside of a lock with the greatest ease.

This launch, which was called the "Delta," is 33 feet in length, has a beam of 6 feet, the draft is 15 inches forward and 18 inches at the stern. She is fitted with 44 cells, weighing in all 2,520 pounds. She is steered by a wheel in front within reach of the three handles which are required for working her. The first of these handles is used for putting the current on or off; the second one for putting it to half speed or full speed; and the third for going ahead or astern. The first one is mechanically moved with the others, so that they cannot be moved without first cutting off the current. Fusible cut-outs are inserted in the circuit, so that if the propeller becomes jammed by weeds or by going aground the motor will not burn up. The speed of revolution of the motor, which is coupled direct to the propeller, is 720 revolutions per minute for full speed, and 510 revolutions for half-speed. The speed is only between five and six miles an hour for full speed. This is perhaps the weak point of this launch. I must say there are times when you are going against a strong current in some parts of the stream where a greater speed would be desirable, and it becomes a little tedious creeping up. It is only in a strong stream that one really finds it a little too slow, and for all ordinary purposes it is quite enough. However, the speed might be very advisedly increased a little, I think, by putting in more accumulators, which the launch could easily carry under the floor without overloading. At present the batteries are all under the seats on each side of the boat, and

* Paper read before the British Association, Section G, in Newcastle-on-Tyne, September, 1889.

thus the whole of the space in the boat is clear for passengers. My launch could easily have carried twenty with perfect comfort. It is here that the electric launch has a very great advantage over the steam launch; if we consider the size of the launch, and the number of passengers it will hold, the electric launch is really the cheaper of the two.

I spent a day in making tests of the performance of the launch, which may be of a little interest, though they do not go very far. I started from my house one morning at 11:45. I made allowance as I went through the locks for the time that was taken in going through locks and so on. and for other stoppages, and timed everything during the whole way. At one minute past four I was near Hambleton Lock, and began the return journey. Stopping an hour at Medmenham Abbey, I reached Bray again at 7:48 P M. During all this time the exact measurements of the time were taken, and the result was that in the outward journey up stream the average speed was one mile in 11.3 minutes, and on coming down stream the average speed was one mile in 10.2 minutes. The average of these two is 790 feet per minute. On arrival at home the stern was attached to a spring balance connected by a rod with the shore. The pull at full speed was then measured, and found to be 97 pounds, which, although it does not accurately represent the pull when the launch is in movement, still it does so with considerably close approximation. This gives us 1.44 h. p., or 1,074 watts, including electrical losses, slip, and all friction. The pressure of 97 pounds, over 790 feet per minute, gives that result. The average pressure at the motor terminals during the run was 78 volts, and the average current was 23 ampères, which gives 1,794 watts expenditure. This gives a total efficiency, including all these losses of slip, friction, the end thrust of the propeller, and the electrical losses in the motor, at 60 per cent., which seems to me an extremely fair performance in one of the first types of electric launches which have been constructed by these makers.

I would suggest that there is a very large field open in future, if somebody could be got to organize it, for the delight of those who wish to use these extremely convenient launchs on the river, namely, that, in order to supply the enormous demand—which will certainly exist after a few years—for charging stations, negotiations should be opened by somebody who has the energy to do so with the Thames Conservancy, and also with the mill owners—which exist at nearly all the weirs—so as to establish charging stations with water power at nearly every one of the weirs on the part which launches frequent, and thus to establish what would undoubtedly be a most perfect method of launching in any part of the world.

After a few remarks from Lord Russell, the president (Mr. William Anderson). in proposing a vote of thanks to Professor Forbes, said there was no doubt a great future for electric launches. One of the Ordnance factories, Waltham Abbey, was under his command, and an electric launch was used there for going about among the network of canals which intersect that factory, in which dangerous operations are carried on, and where it is not desirable to have anything in the shape of fire. The launch answered its purpose perfectly, and it answered in another way incidentally ; that is to say, at night, when it is not wanted for cruising about the canals, it is brought alongside an office, and the wires are carried into the office, and the charge in the batteries is used for the electric light during the hour or two that is required.

On the Design of Transformers.*

BY JAMES SWINBURNE.

The present practice in designing transformers is to use a continuous or closed circuit for the core, and to make this core very large in cross-section and of the shortest possible length, so that the excitation needed to produce the desired induction is small. The tendency is, in fact, to increase the quantity of iron in a transformer, and to decrease the copper.

The idea is that the continuous iron core needs fewer current turns to produce a given induction, and this is generally considered to be of the first importance. The question of loss of power in heating of the cores does not appear to receive enough attention, and the object of this paper is to point out that many common designs produce very inefficient transformers, and that in many cases a particular form of "open circuit" transformer is the best.

If a transformer, with a full load output of 1,000 watts, has a loss of 50 watts in the copper and 150 in the iron, its full load efficiency is 83.5 per cent. But suppose it is put in a house wired for, say, 17 lamps, the full load is on only very occasionally, about half the lamps being the usual maximum. The proportion of the lamps lighted to those wired varies. Some authorities take it that the average is equal to all the lamps on one hour a day; others say three or even five hours a day. If the full load is on two hours a day, and the transformer stands idle, merely keeping its iron hot all the rest of the time, its average efficiency is only 35 per cent. Many will at once say that the loss of 150 watts in a 1,000-watt transformer is absurd, and that modern transformers work at something like 98 per cent. full load efficiency. The figures generally given by makers are so obviously impossible, that one is driven to conclude that the loss in iron is not measured, and, as a matter of fact, it is no easy matter to do so.

It is commonly assumed that a low induction should be used in transformers, because the heat lost per c. c. of iron per cycle is then less; but it is forgotten that more iron is then needed. The volume of iron needed does not vary inversely as the induction; it increases quicker, as the iron is bent round the wire coils. The copper coils have also to surround more iron if its section is increased, and this entails more loss over resistance. On the other hand, the loss per c. c. of iron increases more quickly than the induction, but not much more quickly, so that it may often be advisable to use a high induction.

The excitation in a closed circuit transformer is a matter of little importance, but the loss of power by hysteresis may be, and often is, very serious, especially when it is remembered that transformers used in houses have their full load on only very occasionally, while the loss by reversal is going on continuously. The author has calculated tables, the dimensions being given in inches, with the object of being useful; as in practice one always uses inches (when one's sole object is the advancement of science of course he rises to centimetres), showing the best forms that can be given to closed circuit transformers for various loads, the loads being on for different numbers of hours per day. These tables show that, even for cases where the full load is always on, the cores should be smaller than is now usual; and that for most housework, when the transformer is only occasionally partially loaded the cores ought to be exceedingly small to give a high efficiency, and that the high efficiency is accompanied by excessive variation of secondary electromotive force and high cost.

The author's transformer is of the Ruhmkorff coil type, but has the core brought out past the ends of the copper coils, and the wires spread out into a sort of thistlehead or hedgehog. The induction is not great at any region in the air, and the magnetizing current is not large enough to balance the advantage of the small volume of iron needed.

It would seem that from the point of view of the coal bill at the central station, that the system of putting transformers permanently on in houses is hopelessly bad. But the coal bill is not everything. The cost of electrical energy does not vary as the coal burned. The house transformer system has also the disadvantage of variations of secondary E. M. F.

Assuming the private transformer system to be necessary, the open circuit transformer is better for such sizes as 50 lights. If larger sizes are needed the hedgehog kind easily distances the closed circuit; for its drawback is its large magnetizing current, and the excitation is less in proportion as the transformer is increased. In all cases a large transformer is more efficient than a small one; its percentage loss decreases faster than the dimensions increase, but the dimensions increase very slowly with the output, so that it takes a very large transformer indeed to get an efficiency of 98 per cent., namely, about 50,000 watts.

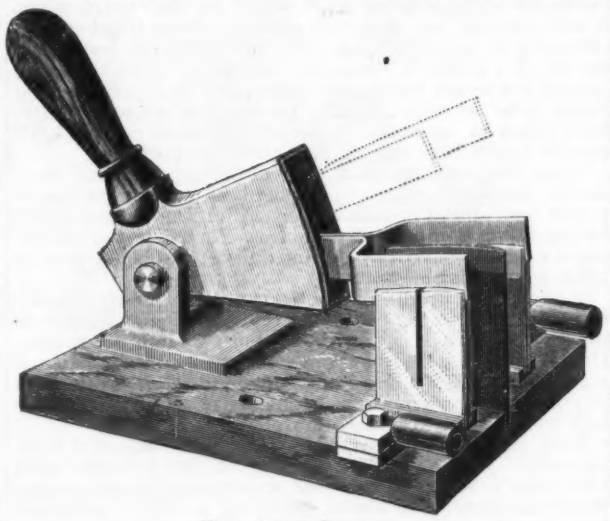
Open circuit transformers of the type introduced by the author can be made, in which even the full-load efficiency is higher than can be got with a closed circuit; while the very low average efficiency of house transformers can be remedied without great variations of secondary pressure or heavy cost.

If the figures for loss in iron here taken are very low, as seems probable, the arguments in favor of this form of open circuit transformer are very much strengthened. The loss in iron also depends on the frequency, so the higher the frequency the better these transformers are in comparison. It is curious to note that this appears to be a step backward, according to most people's ideas, and that it is also a step toward the original practice of the pioneers of transformer work—Messrs. Gaulard and Gibbs.

* Abstract of paper read before the British Association, 1889.

The Ajax Switch.

The Ajax switch, represented in the accompanying cut, has been designed especially for high electromotive force and large current work. It is actuated by a single straight,



THE AJAX SWITCH.

flat spring, acting directly upon the tongue or current carrying blades. The switch represented has broken a current of 500 volts and 225 ampères, equal to 150 h. p. by the slowest possible movement of the handle, thus causing the switch to break entirely by its own action the entire current independently of the movement of the handle by the operator. The switch showed no bad effects from sparking or arcing, as they are entirely avoided by the instantaneous action of the spring. The above experiment effectually tested this switch, which was designed for 200 ampères, and which we have ourselves had the pleasure of examining. This is the smallest size, the switch being specially well adapted for heavy currents, and made for as high as 1,000 ampères. They are manufactured by C. S. Van Nuis, of this city.

On Hysteresis in the Relation of Strain to Stress.*

BY PROF. J. A. EWING, F. R. S.

It is now well known that when an iron wire is subjected to the alternate application and removal of tensile stress, many times repeated, certain of its qualities which are affected by the changes of stress exhibit hysteresis with regard to the changes of stress. If the load is cyclically varied between definite limits these qualities do not have the same values at corresponding intermediate points during the application and removal of load; there is a hysteresis or lagging in the change of quality which in some cases appears to be of a static character, that is to say, independent of the time-rate of variation of stress. Conspicuous instances of this action are seen in the change of magnetic and thermo-electric qualities under change of stress, some of which have been described by the author in former papers.

It is natural to look for an effect of the same kind in the extension and retraction which the wire undergoes. We should expect that, after the change of loads has been frequently repeated, so that a cyclic *régime* is established, the wire will, for any value of load intermediate between the two extremes, be longer during unloading than during loading. Evidently, if such an effect exist, it must be small, as it is well known that the proportionality of strain to stress which is expressed by Hooke's law is at least approximately exact. Sir W. Thomson's experiments on the damping of torsional vibrators have long ago shown that an action of the kind spoken of occurs in quickly-performed cycles of torsional strain. But it does not seem to have been looked for in slow cycles of longitudinal pull.

The author has, with the assistance of one of his students, Mr. D. Low, looked for the effect in question and has found it, not only in iron, but in steel, brass and copper wires. He has not yet examined other metals.

The experiment consisted in observing, with much optical magnification, the extension of a very long piece of wire, directly loaded with lead weights.

The result of these experiments makes it clear that in conditions of loading such as those they deal with there is a decided departure from Hooke's law, one effect of which is that some work is done upon the material when it is put through a cycle of stress change. If the relation of strain to stress were represented graphically, the curves would form loops inclosing a certain area. This result has a sufficiently obvious bearing on the conclusions of Wöher with regard to the deteriorating effect of repeated variations of stress.

* Abstract of paper read before the British Association, in Section A, Newcastle-on-Tyne, September, 1889.

Telephone Communication between London and Paris.*

BY W. H. PREECE, F. R. S.

The practicability of speaking by telephone between London and Paris has recently been carefully examined, both by the French and the English electricians. The distance between the two places is 275 miles, viz., 74 miles between London and Dover, 21 miles from Dover to Calais and 180 miles from Calais to Paris. It is very easy to speak over such a distance, if the wires be aerial and of thick copper; but the insertion of underground wires at each end, and of a cable in the middle, place difficulties in the way that have to be surmounted. It is not a question of apparatus, it is solely the distribution of the electrical resistance and capacity of the different portions of the line and the arrangement and material of the wires.

Speech is already commercially maintained between Paris and Brussels (190 miles), Paris and Lille (158 miles), Paris and Rouen (80 miles), Paris and Havre (135 miles), Paris, Lyons and Marseilles, the latter being a distance of nearly 600 miles; but in all cases they are aerial wires, excepting for a short length (about two miles) of underground work in Paris.

The author has experimented on the cables between Dover and Calais, between Holyhead and Dublin, and between South Wales and Wexford. The conditions to be fulfilled are very simple. The circuit must be metallic, the material must be copper, and the product of the resistance of the line R and its capacity K must not exceed a certain figure. It has been determined roughly by experiment that when

$K\,R$ = 15,000 speech becomes impossible.
= 12,500 " " possible.
= 10,000 " " good.
= 7,500 " " very good.
= 5,000 " " excellent.
= 2,500 or under, speech becomes perfect.

We have thus a species of Beaufoy's scale applied to telephonic communication.

A circuit approaching as nearly as possible one between London—Paris was made on an artificial cable and it was found to comply with the requirements.

An actual circuit was then made from Worcester, through twenty-seven miles of the London underground system, to Baldock, on the Great Northern Railway, giving similar electrical conditions, and with the same result.

It may be considered as absolutely settled that speech is possible between London and Paris.

On the Purification of Sewage and Water by Electrolysis.*

BY W. WEBSTER.

The paper was divided into four sections, bearing on the different values of the methods for the oxidation of organic matter in solution, leading up to the action produced by the electric current :

1. By natural processes due to the action of atmospheric oxygen dissolved in water.

2. By the action of the soil, due to oxygen in its pores, and also to the iron oxides therein acting as purveyors of oxygen.

3. By artificial disinfectants, represented by chemicals such as chromic acid, permanganates, chlorine, etc., chlorine having a powerful oxydizing action upon all organic matter, living or dead.

4. The electric current produced by mechanical or chemical power. The fact that water and the salts contained therein are easily decomposed, provided the current of electricity is of sufficient intensity, is an explanation of the whole system. The changes taking place in sewage when electrolyzed depend chiefly on the splitting up into their constituent parts of sodium, magnesium and other chlorides, nascent oxygen and chlorine being set free at the positive, and the bases at the negative pole.

(*a*) The adaptation of the electric current to filters and filter beds in such a manner that putrefaction cannot take place in the pores of the filtering media, owing to the constant presence of nascent oxydizing agents, the filter always remaining clean, because the impurities are consumed as fast as they present themselves, all harmful organisms being destroyed.

(*b*) The production of disinfectants for household purposes.

(*c*) The application of the electric current to plates of oxydizable and non-oxydizable material, fixed in such manner that sewage passing between them not only receives a precipitating agent, but the putrefying organic matter in solution is oxydized to any extent that may be required, the action being produced by metallic oxychlorides, nascent oxygen and chlorine, thus combining in one process the results obtained by both precipitation and irrigation, the intensity of the current not of necessity exceeding two volts, the action entirely depending on the quantity of the current employed. The oxydizable plates are by preference, for various reasons, of iron. It is contended that the process follows more nearly natural action than any hitherto suggested.

*Paper read before the British Association in Section G, Newcastle-on-Tyne, Sept., 1889.

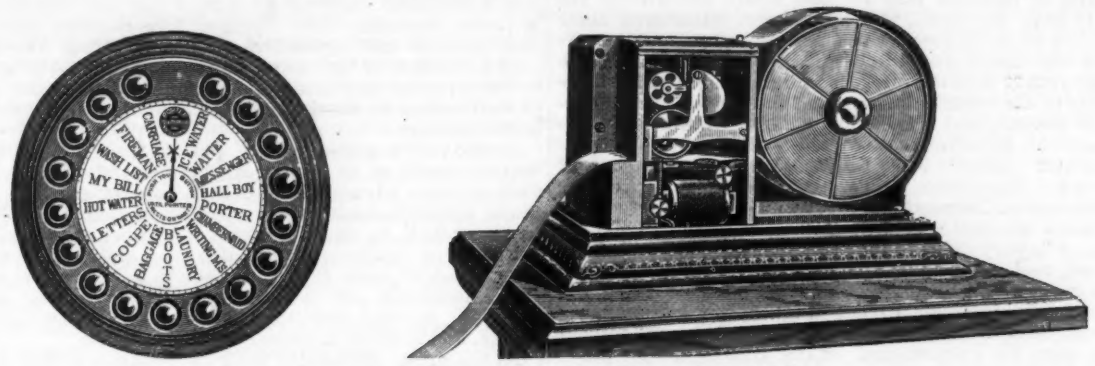
*Abstract of a paper read before the British Association, Newcastle-on-Tyne, September, 1889.

The Teletype Annunciator.

We illustrate in Figs. 1 and 2 the new annunciator apparatus manufactured and placed upon the market by the Porter Teletype Company of this city. The invention accomplishes just what its name (Teletype) signifies, that is to say, it prints at a distance, and has been specially devised for police system, hotels, stores, warehouses, etc.

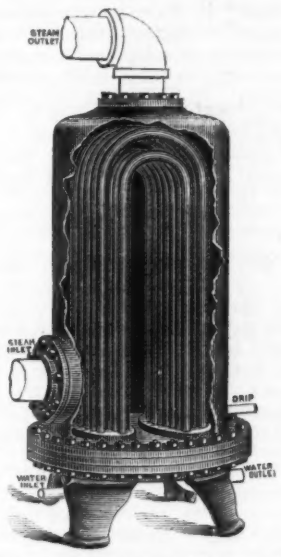
In hotels, the many advantages of conveying at once and directly to the office the wants of a guest will be readily recognized, and for this purpose speaking tubes have been employed. While this overcomes many of the objections to the old style of annunciators, the tube system necessitates a great waste of space and causes much confusion.

In Fig. 1 is represented the teletype box which is placed in each of the rooms of the hotel, and is about five inches



FIGS. 1 AND 2.—THE PORTER TELETYPE.

in diameter. It is made of metal, wood, and of any special design, to correspond with decorations of the room. On the dial of the box are printed the ordinary wants of the guest, but the number is not limited, and can be increased or diminished as desired. Around the outer edge of the box and opposite each want are small push buttons, which



THE "ADVANCE" FEED-WATER HEATER.

the guest has simply to press, and the movement of the small hand in the centre assures the receipt of the message at the office.

Fig. 2 represents the machine, or printer, which is placed in the office, either directly on the desk of the same or upon an upright case to correspond with the furniture, as desired. It is about the size of an ordinary stock indicator, and is handsomely finished. The moment a guest pushes a button before described, the number of room with want or wants is instantly printed on the tape of the receiver in clear, plain type. The time each call is sent in may also be added if desired. A complete record is thus kept of each want, time sent in, by whom answered, etc., etc. The advantages of these points will be understood by hotel proprietors as most valuable, as a better record can thus be kept of the entire service of a hotel than by any other means.

Precautions to be Adopted in Alternate Current Lighting.*

BY KILLINGWORTH HEDGES.

In a paper entitled "The Fire Risks of Electric Lighting," which was read at the Southport meeting of the British Association in 1883, the author urged, he believes for the first time in this country, the necessity of regulations and the adoption of proper safety appliances. The fire insurance companies have universally recognized the importance of having the leads in the houses thoroughly insulated and protected by cut-outs, and the rules which have been published by the Institution of Electrical Engineers, and by some of the leading fire insurance offices, have been so far successful that no fire of any magnitude has been caused by the electric light.

In this paper the author treats of a new danger which may occur when transformers are employed to convert currents of high tension into the pressure suitable for the incandescent lamps. The danger of fire may be obviated by thorough insulation; but should an alternating current of 1,000 volts or more break through the transformer into the house circuit, a dangerous shock might be taken by any one inadvertantly touching the lampholder or some unprotected part of the circuit, if any portion of his body was in connection with a wire of opposite polarity, or in some instances with the earth. Such an accident might possibly occur, although the lamps would give no indication that the electromotive force was more than normal.

The conditions which would cause such an effect are stated, and the precaution necessary is either to earth the secondary circuit, which has, however, certain disadvantages, or to connect one or both of the leads to a safety appliance which would automatically divert any excess current to earth, and at the same time shut off the supply in that portion of the faulty circuit by the fusion of the lead wire or mica foils in the main cut-outs.

The Cardew static arrangement, which has been adopted experimentally by the London Electric Supply Company, and the vacuum protector designed by the author, both effectually prevent any leakage from the primary to the secondary circuit. Numerous experiments have been made with the last apparatus to ascertain the distance which an alternating current of high E. M. F. will leap across the two electrodes which were fixed in the opposite ends of a glass tube from which the air has been partially excluded. The results differed considerably from those given by De la Rue in his experiments with a continuous current, and a phenomenon was noticed, that the arc after starting between the two points almost invariably extended itself to a bow shape, and ran back to the base of one or both of the platinum electrodes, one of which nearly always fused, leaving that opposite intact.

* Abstract of paper read before the British Association, Newcastle-on-Tyne, September, 1889.

The "Advance" Feed-Water Heater for Electric Plants.

The "Advance" feed-water heater, which is represented in the accompanying illustration, has been specially designed to fill in a thoroughly practical manner the requirements of economical service. It is compact and systematic in design, of a very simple construction, and ready for use by connecting the pipes to and from it. The heater consists of a nest of U-shaped seamless drawn brass tubes encased in a cast-iron shell. The exhaust steam enters the shell near the bottom, as shown in the cut, and is discharged from the outlet at the top.

The feed-water enters at the bottom and is circulated through the nest of brass tubes within the cast-iron shell, taking up the heat from the exhaust steam, and is discharged from the heater on the opposite side at a temperature of from 200 to 210 degrees Fahrenheit.

Great care is taken in testing the heaters, and every one after it is completed is subjected to a cold water pressure of 175 lbs. thus insuring absolute tightness at every point. These heaters are manufactured by J. B. Davis & Son, Hartford, Conn., and are sold by B. F. Kelley, this city.

Eureka Dynamo Belting.

The Eureka dynamo belt, illustrated on this page, is the result of careful experiments and much study, the aim being to produce an article for the transmission of power to electrical dynamos, and from electric motors, which shall embrace all the qualities so much desired in belts for this purpose, namely: pliability, freedom from stretch, straightness in the running of the belt, the maximum traction between a belt and a pulley, and all at a moderate cost. It is constructed as follows: A belt in single thickness of fulled rawhide is first made, and subjected to a running test by a patent machine whereby the stretch is removed, the quality of every inch thoroughly tested, and the belt brought into working condition. For this purpose the full thickness of the very best portion of the heaviest steer hides is used. It is made in one strip the full width of the belt, of which it forms the inner or wearing surface.

Upon the outer or upper side of this fulled rawhide is cemented a special weave of cotton fabric in two strips, each half the width of the belt. This is a very strong article, and has but very little tendency to stretch. To remove what stretch there is, it is subjected several times to a running and stretching test by a patent machine.

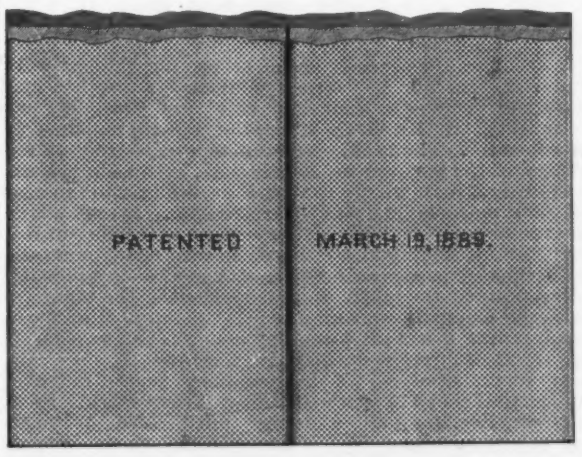
This fibre is filled with a special gum, prepared specially for the purpose. The fulled rawhide and cotton fabric are then carefully fastened with waxed thread stitching, in addition to the cementing. The completed belt having been subjected to a running and stretching test, it receives upon the surface of the cotton fabric a coat of gutta-percha paint especially adapted to this purpose. Belts made in this way do not stretch appreciably. They run perfectly straight. The fabric treated by special method is water-proof, does not "go and come" in atmospheric changes, and prevents the fulled rawhide from becoming crooked or stretching.

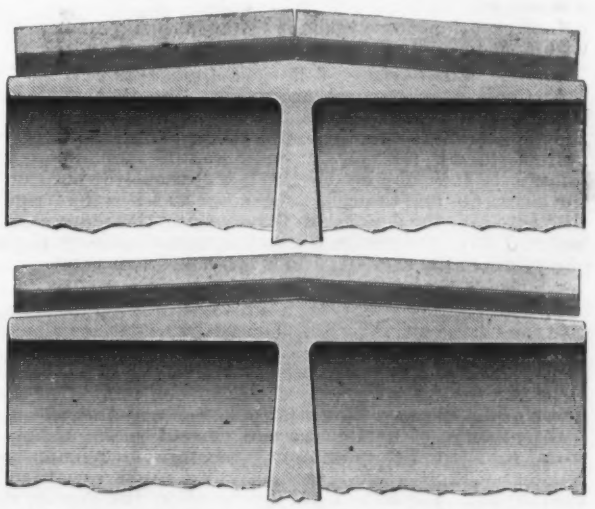
A plan of this belt is shown in Fig. 1. A cross section of it is shown in Fig. 2, which illustrates one special advantage of the belt. The edges rest down in contact upon the edges of the pulley, the centre of the belt acting like a hinge, and the difference in this respect between the Eureka dynamo belts and other double belts is illustrated in Figs. 2 and 3. These belts are easily made endless, and they run without noise.

Fulled rawhide is a hide tanned a little on the surfaces and the inner parts, treated afterward by a mechanical process. By this mode of construction the fulled rawhide can be used without the stretch and crookedness which have heretofore existed in rawhide belts for electrical purposes, and at the same time its desirable features are retained, namely: the most perfect traction that can take place between a belt and a pulley, for no other kind of belt possesses this quality to a degree equal to that of fulled rawhide.

These belts have been thoroughly tested, and shown to possess the qualities which have long been sought by electricians and those running electric dynamos and motors.

They are manufactured by the Page Belting Company, Concord, N. H.





FIGS. 1, 2 AND 3.—BELTING FOR DYNAMOS.

The Improved Stoddard Ceiling Rosette.

The Empire City Electric Company, of New York, who, with characteristic push and enterprising business energy, have brought out many new and desirable articles of great value in electrical construction work, have recently placed upon the market a new and improved form of the Stoddard ceiling rosette cut-out, which we illustrate in the accompanying figure. It will be noticed that it is exceedingly compact and very easily and quickly adjusted, and adequately fills the purpose for which it was designed. Although only just brought out, it is in great demand, and the orders are numerous from all parts of the country.

Magnetic Observations.

The British Association Committee appointed for the purpose of considering the best means of Comparing and Reducing Magnetic Observations, reported the establishment of regular magnetic observatories at the United States Naval Observatory at Washington and at Los Angeles in California. The instruments used are of the Kew pattern.

THE STODDARD CEILING ROSETTE.

Further, that the plan proposed by them in their Third Report for the Comparison and Reduction of Magnetic Observations, has been adopted at the United States Naval Observatory at Washington, which is now prepared to take part in the general scheme of co-operation proposed by the committee. Copies of the photographic registers of the three elements for April 21–30, May 1–31, and for June 1–30 have been forwarded to the committee from Washington, with tables of scale and temperature coefficients; and also two prints showing the reduction of the declination for the year 1888, by means of a graphic composite curve, made by tracing over one another with a pantograph the daily curves of the month, and then drawing a curve through them to show the monthly means.

There are also forwarded from Washington a set of prints showing the comparison of the disturbances of declination and horizontal force at Washington for ninety-nine days of 1888, and another set of prints showing the comparison of disturbances of declination on certain selected days at Washington, Los Angeles and Toronto, all reduced to the same time-scale of 30.6 millimetres for two hours, *i. e.*, the time scale of instruments of the Kew pattern.

The committee are more than ever of the opinion "that the establishment of regular magnetic observatories at the Cape of Good Hope and in South America would materially contribute to our knowledge of terrestrial magnetism."

The committee consider that it would be desirable to publish annually in a collected form for certain selected days the curves of the three magnetic elements, *i. e.*, declination, horizontal force and vertical force, taken at the different English and Colonial magnetic observatories, choosing for selection in 1888 the days for which the curves are published in the "Greenwich Observations."

Electro-Physiology.*

BY M. D'ARSONVAL.

The aid that therapeutics derives from the physical agents (heat, electricity, pressure, cold, etc.), becomes every day more important and rightly so. The employment of physical agencies is not complicated with any poisonous effects; the action can be graduated at will, and the application repeated without the least inconvenience.

Physiology has proved that of all the physical excitants, electricity is the simplest and most efficacious to stimulate the functions of the nerves and muscles. Furthermore, all the recent progress made in electrical science shows us that there is no agent known to-day as easy to handle and prescribe as electricity.

The advance of the industry has familiarized a large part of the intelligent public with general physics, but there is still the tendency in medical circles to treat physics and chemistry as only accessory studies for the doctor of medicine.

Many practitioners employ electricity to-day with success, but in order that their observations may be of value in the advancement of science, it is essentially necessary that they should know the exact physical conditions under which they work. For this reason it is necessary for doctors employing electricity to understand the precise and simple terms of the electrician, and to dispense with arbitrary measurements. The congress of 1881 has already effected great progress in making obligatory the employment of the volt and milliampère as the continuous current measure in electro-therapeutics, as proposed by M. d'Arsonval and M. Marey.

To obtain this result, all that is necessary is to borrow from the electricians their methods and instruments, and after having subjected them to some slight modifications, they are fitted for their new use.

But electricity is not always employed in physiology and medicine in the form of a continuous current; we may even say that this method is the exception, as it only applies to one of the two great aspects of life, *nutrition*.

On the other hand, to exercise *function* it is an intermittent current or electric shock which is had recourse to. In this second case the problem of measurement becomes much more complicated, for the physiologist cannot borrow a great deal then from the electrician. The nerves and muscles respond to the electrical stimulus by reactions which are their natural disposition. Further, contrary to the case with inanimate subjects, the nature of the excitation will completely alter the excitability of the living recipient, if it does not realize certain physical conditions, the knowledge of which is the exclusive domain of the physiologist.

Hence, to apply electricity with success to the art of healing, it is necessary to be at the same time physiologist and electrician: physiologist, in order to understand the fundamental properties of living subjects; electrician, to appreciate with certainty the physical properties of the excitant employed.

Living beings are not only sensible to electricity, but they produce it themselves, and by means which are natural to them in the same manner as they produce heat, light, mechanical work, etc. This *modus faciendi*, which differs from those of the chemist and physician, establishes a decided line of demarcation between the inorganic physics and biological physics, a complex science of recent date.

Finally, the industrial applications of electricity have made of this force a formidable agent, the effects of which, comparable with those of lightning, have given birth to accidents, the study of which is of the highest interest to the physiologist and physician.

From these various considerations, we have been led to think that it will be of interest to direct the discussions of the Congress to the three following points:

1. The comparison of the effects obtained by the employment of various medical apparatus. The necessity of defining the currents employed.

2. The nature of the self-produced electrical phenomena in living beings.

3. The effect of shocks from continuous and alternating currents employed in the industry on living beings and as a corollary.

4. Precautions to be taken in electrical installations. We will glance rapidly at these four points.

Comparison of Medical Apparatus.

A. Continuous current apparatus. The first point has been resolved by the congress of 1881, which has imposed the application in practical units derived from the C. G. S. system, to wit, the volt for pressure, the milliampère for quantity. It would be well to add to these the nature of the electrodes and their surface contact with the tissues, that is to say, the density of the current per square centimeter. This consideration is generally unnecessary in physiology, where the excited surface is reduced to a point.

Intermittent Current Apparatus.

B. This form of apparatus is chiefly employed to stimulate the nerves and muscles. Let us first consider what is the fundamental law of the electric excitability of these organs. A constant current provided by one or two Daniell's elements, for example, causes a quick contraction of the nerve or muscle each time it is applied or withdrawn.

If by means of a rheostat the current is *slowly* raised from zero to its maximum, the muscle remains in repose, but it contracts if produced by a rapid variation of the current. The more rapid the variation the greater the contraction. In fact, within the limits indicated above, the nerves and muscles are irritated by the variable state, and not by the permanent flow of the current.

The intensity of the muscular contraction is not necessarily in proportion to the energy of the discharge of a condenser. The physiological excitation is not defined when we know the fall of potential and the quantity of electricity set in motion. It is necessary to know also the time of the fall and the phases of that fall; other things being equal, the curve thus obtained constitutes the "characteristic of excitation."

By reducing the discharge to an infinitely short time, we have evidently only to consider the quantity of electricity set in motion. This condition is considered realized in practice by the discharge of a condenser and the induced current on breaking the circuit of an induction coil. This condition of the instantaneous flow of the discharge is only realized in the case of a condenser with the condition that the apparatus discharge into a conductor of relatively low resistance. It is therefore wrong in exact experiments to try and excite a body of such high resistance as the nervous tissues directly by the discharge of a standard condenser. A Leyden jar can be discharged through a nerve or muscle without causing the least contraction if we retard the discharge by means of a cotton thread. It is therefore preferable to send the discharge of a condenser through the primary wire of an induction coil, thus obtaining induced currents always equal and without direction.

It is easy to measure in coulombs the current induced on breaking the circuit by discharging it through a ballistic galvanometer, and comparing the discharge with that of a standard condenser, in the manner described by me before the Biological Society in 1884. The difficulty consists in getting an interrupter giving regular breaks when they are of considerable frequency. It is quite useless, in my opinion, to have more than 50 interruptions per second, this frequency being quite sufficient to cause tetanus of the muscle from the super-imposed shock.

The only type of induction coil which gives a very regular graduation of the induced current is the movable coil apparatus of Siemens and Halske, better known by the name of Bois Reymond, and which was introduced some time since by A. Tripier for use in electro-therapeutics. As regards numerical graduation, this apparatus has the disadvantage that it does not offer a simple relation between the intensity of the induced current and the amount of movement of the coil, and it is cumbersome to excite very delicate nerves. In certain cases of the excitation of the diaphragmatic nerve M. Brown-Sequard and myself separated the two coils of Gaiffe's apparatus to a distance of more than 1.4 m. I have calibrated our instrument in coulombs by means of a ballistic galvanometer. For very delicate experiments, we can, as I have proposed, replace with advantage this apparatus with two concentric circular coils, whose planes can be gradually rendered perpendicular to one another by continuous rotary movement. The intensity of the induced current would then be proportional to the cosine of the angle formed by the two planes.

A third method of regulating the induced current consists in weakening the battery current in fixed proportions by the interposition of resistances in the primary coil. This method is the most disadvantageous of the three, as it changes the duration of the variation of the inducing current, and, therefore, the duration of the induced one. Static electricity can be administered in the same manner, when employed under the form of a continuous flow, by means of the galvanometer. The intensity of the flow given by a good four-plate Holtz machine has never exceeded a millionth part of an ampère in my experiments. As regards pulsations, they are always produced in the same conditions by employing one of Lane's electrometric cells of known capacity.

To graduate the intensity regularly, it suffices to charge the cell in the primary circuit of an induction coil with movable coils.

It is far more difficult to administer the currents when employing magneto apparatus, for their intensity depends upon a number of variables (speed of rotation, the excitation of the field, the distance of the armature from the field magnets, etc.). To resume the subject of calibrating faradaic apparatus, it is sufficient, in practice, to indicate the value of the current induced on breaking the circuit in micro-coulombs corresponding to each distance of the moveable coils, for a fixed value of the inducing current.

These two indications could easily be supplied by the manufacturer.

The electromotive force of the induced current varies as the quantity of electricity itself, since the time of the induction remains constant. Consequently the energy of the induced current varies as the square of the quantity of electricity set in motion. It is only then necessary to indicate the value at one point of the scale.

(To be Concluded.)

* Report made to the International Electrical Conference, Paris, August, 1889.

The Mackay Testimonial.

It will be remembered that a few months ago a beautiful autographic testimonial was presented to Mr. John W. Mackay by the staff and employés of his successful Commercial Cable Company. The work was artistically engrossed, and contained the signatures of every man connected with the enterprise, each town, or city, or cable station being also appropriately represented in some tasteful design or sketch of some conspicuous landmark; while the expressions of esteem, in formal but hearty phrase, were supplemented by poetical utterance of the same laudable feelings. The whole has now been magnificently reproduced in book form, making a rich and handsome souvenir, for a copy of which we are indebted to Mr. G. G. Ward, the general manager of the company. The book, or album, is prefaced by an engraving of the portrait of Mr. Mackay, by the French artist Cabanel, than which it would be difficult to imagine anything more lifelike and characteristic. It may not be generally known that Mr. Mackay is now residing in this city. An interesting idea of his daily work is given by one of the Sunday papers as follows: "A modest-looking tray that contained the lunch of the president of the Commercial Cable Company was carried into the top floor of No. 1 Broadway at 1 o'clock yesterday and put before a large, gray-eyed and serious-looking man who sat in one of the many rooms occupied by his company, gazing out over the magnificent expanse of New York Bay. From 9:30 or 10 in the morning until 5:30 or 6 in the afternoon John W. Mackay works these days as steadily as the humblest telegrapher in his employment. He loves pleasure of the right kind, but he loves work more. Said a friend who often dines with him: "Mr. Mackay knows what is good, and how it should be served and eaten. His dinners at the Hoffman to a chosen coterie, of which Roscoe Conkling, Bob Ingersoll, Charles Crocker, Larry Jerome, John P. Jones, Billy Florence and Col. Tom Ochiltree were regular members, used to be famous. All these and four others were on one occasion within two years Mr. Mackay's guests in the Moorish room. Three out of the ten are now dead. But Mr. Mackay is to-day one of the most active and industrious men in New York City, His eight hours a day and more accomplish a great deal of work. He is finishing 4,000 miles of new telegraph lines in the South and Southwest now. His wires are of copper and his instruments and machinery all of the newest kinds. As Mr. Mackay walks up Broadway in the evening he sees in Park Row the site of the house he lived in when he came to this country at the age of six. He was a New York boy then, and he has been a stalwart American ever since. His father was a clergyman in Ireland, and the boy has been well grounded in letters. He became in New York a devotee of the stage, went everywhere, and got so that he knew a great deal of Shakespeare by heart. Several well-known actors could tell and have told with emotion how his help smoothed their declining years."

Electric Mining Apparatus for South Africa.

Among the electric mining plants which are now being installed by American manufacturers of electric apparatus are a number not only in this country but abroad, and it is no unusual thing to hear of another mining company which has decided to adopt electric power in its mines.

Among recent contracts which have been awarded the Sprague Electric Railway and Motor Company, of New York, for electric apparatus, is one which comes from Transvaal, South Africa, and it is interesting to note that the fame for American electric mining apparatus for durability, economy and convenience is recognized in those distant fields as well as in this country. The company which is now installing Sprague apparatus in Transvaal is the Forbes-Reef Gold Mining Company, who have ordered through Chester & Gibb, mining engineers of London, a complete electrical equipment for the transmission of power, including four Sprague long-distance transmission motors and dynamos for transmitting 140 h. p. over a distance of two miles. The primal source of power is water power, and this point is connected with the point of distribution by insulated wires carried on poles directly across country.

At the power station will be placed three Pelton water wheels furnished by Fraser & Chalmers, of Chicago. To each of two wheels will be belted directly one long distance transmission-of-power Edison dynamo of 50,000 watts or 67 h. p. capacity each. The other wheel will be belted to the dynamos of the same type and voltage as the others, but of only 40,000 watts or 55 h. p. capacity each. These machines are wound especially according to the Sprague method for the long-distance transmission of power, and have an extremely high efficiency.

At the mines are located the four Sprague motors which are belted directly into the mining apparatus. These motors are divided into two groups; two 20 h. p. Sprague motors and one 80 h. p. motor forming one group, and a single 20 h. p. Sprague motor forming the other group. Each group is supplied with current by a separate set of wires, thus practically insuring a constant flow of electricity under all circumstances. The motors are wound with the regular Sprague differential winding, and will keep at a constant speed in spite of the varying loads thrown on the mining machinery.

The question of efficiency or the amount of primal power which is delivered at the farther end of the transmission is one of extreme importance. Upon this point electric transmission compares very favorably with all other methods of transmitting power. In this case the efficiency of the entire system, from the turbine pulley to the mining machines at the farther end, is about 70 per cent.; that is, 70 per cent. of the energy delivered from the engine to the pulleys in the power station is given off the motor pulleys for work.

A Successful Dry Powder Storage Battery Plate.

To the Editors of The Electrical World:

Will you kindly permit me to take up a small portion of your space in reply to a communication which you publish in your current issue, from Mr. Geo. B. Prescott, Jr. In the first place I wish to say that I have no intention of entering into any personal discussion with Mr. Prescott on this or any other subject. The mere statement by Mr. Prescott of my lack of information on the subject of storage batteries carries no weight as an argument, nor do any personalities, for that matter. Mr. Prescott is young yet, and as he grows older it is to be hoped he will grow wiser, and learn, among other things, that the whole knowledge of even the subject of secondary batteries is not centered in him, and that others besides himself are entitled to have opinions of their own, without being told that they are ignoramuses because their opinions do not coincide with his own. My statements were made in good faith and are open to fair criticism, but I must refuse to pay any further attention to personalities. I would like to call attention to one or two points which are mentioned in this communication. I think I fairly stated my point in regard to the effect that Judge Coxe's definition of what a secondary battery is, has upon the status of certain forms of primary batteries, even if they were prepared in precisely the same way that the Accumulator Company claim to control. What material difference exists between a plate pasted with peroxide of lead and another which was pasted with litharge, which was transformed into peroxide by the action of an electric current, it is difficult to see, as also whether a plate be pasted with sponge lead or pasted with an oxide of lead which is reduced to sponge lead by the action of an electric current. It would seem that the plates are practically identical in character, although made by different methods; and if a plate which has its active material formed up into peroxide and a plate which has its active material reduced to sponge lead by the action of an electric current, will give a current of electricity when they are immersed in a solution of sulphuric acid and water, it does not appear why a plate to which the peroxide has been directly applied and a plate to which the sponge lead has been directly applied, will not do the same thing when placed under similar conditions. Yet one of these pair of plates is a secondary battery and the other pair a primary battery, according to Judge Coxe's definition. No solution of either electrode takes place in either case, nor is it necessary, as this form of secondary or primary battery does not act in this way. As to the increase or diminution of the weight of the plates of a secondary battery, I will venture to say that no secondary battery plate was ever made by the pasted process, which, after it was once fully formed and then completely discharged ever weighed the same as it did when first made, and also that it does not follow, that because a primary battery cannot be completely regenerated, but only partially so, it is not a secondary or *storage* battery according to my conception of this term. I am much pleased to be informed by Mr. Prescott that I have "*always* employed the paste or Faure method" in the batteries which I have made. I thought I knew a little about what I personally had done, but it seems not, and I have to thank the gentleman for his gratuitous information. I may say, however, with all due respect to him, that I have succeeded in making others prepared by the dry powder method, which, in my humble opinion, are fully equal, if not superior, to any which have heretofore been made by the pasted process. But I may be mistaken. If I am, I hope the gentleman will correct me. It does not follow that because he has not succeeded that others may not. But of this more anon.

BROOKLYN, Sept. 25, 1889. E. R. KNOWLES.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, Sept. 30, 1889.

In Town.—Among the prominent callers in town this week were Eugene Phillips, of Providence; A. Knapp, of Chicago; S. A. Duncan, of Pittsburgh; W. A. Crowdus, of Nashville, Tenn., and S. Z. Mitchell, of Seattle, W. T.

Mr. Chas. L. Eidlitz, who has been associated with Mr. A. Noll in the electric light wiring and construction business, was married at St. Patrick's Cathedral, this city, on Sept. 25, at 5 P. M., to Miss Etta Lydon. Mr. Eidlitz is in receipt of congratulations from a wide circle of friends and acquaintances.

The Smith & Shaw Pocket Battery, made under the supervision of Mr. Henry Schwindt, 435 Seventh avenue, New York, has been very much improved. Mr. Schwindt is an electrician and mechanician of repute, and capable of furnishing a first-class medical battery, in compact form, for general medical electrical applications.

The Palermo Mica Company, of New York, have special facilities for the production of mica in any shape and style desired for every kind of electrical apparatus, dynamo commutator sections, armatures and field magnets, motor parts, condenser sheets, electric gas lighting attachments, static resistance plates and numerous other applications. They own and control the largest mica mines in the world.

Mr. S. Z. Mitchell, of Seattle, W. T., has been in town this week, and reports that city to be booming again. In fact, real estate has risen in value since the big fire. The Northwestern Electric Supply and Construction Company, with which Mr. Mitchell is prominently connected, is putting in a 1,750-light Edison plant at the Portland Hotel, Portland, Ore., and is to build four electric roads there. In Seattle, Mr. Mitchell expects that the new city will be wired for at least 10,000 to 15,000 lights.

The Excelsior Electric Company, of 115 Broadway, are, I am informed, vigorously pushing their suit against the Baxter Motor Company for infringement of the Excelsior patents on automatic regulator devices for cutting the field in and out, in their arc motors. The suit has been brought in the United States Circuit Court at Baltimore. The Excelsior Company have, by the way, just received a patent on automatic regulation for incandescent lamps, and for sundry other improvements by Mr. Hochhausen.

The New York Insulated Wire Company have issued a neat little price list of their celelebrated Grimshaw wires for telegraph, telephone and electric light purposes, B. D. wire, Grimshaw tape and splicing compound. Tables of the various wire gauges are given, also simple definitions of the electrical units and formulæ. There are also notes on measuration of the properties of circle, etc., formulæ for rolled iron beams, and much information of general usefulness, the whole pamphlet being very tastefully got up.

The Auditorium Hotel, Chicago.—The contract for the fixtures in the new Auditorium Hotel in Chicago, has been awarded the Mitchell-Vance Company, of this city. This will be one of the finest hotels in the United States when fitted up. It is connected with the Auditorium Opera House, which is renowned already as one of the largest meeting places in the world. The work will be of the finest description and of special design, and will be installed by A. H. Rewell & Co., Chicago agents of the Mitchell-Vance Company.

The Serson Electric Company.—I called on the Serson Electric Co., 111 Broadway, a few days back, and saw their new primary battery, which, it is claimed, will fill the long felt want for a reliable and practical primary battery for incandescent work. A thorough test of the battery has been made by Mr. W. J. Comly, mechanical and electrical expert, who reports very favorably of the capabilities of the battery in maintaining a high E. M. F. and steady current when working, and freedom from all polarization and local action.

The Magnolia Anti-Friction Metal Company, 74 Cortlandt street, New York, showed me last week some beautiful test pieces of their bearings, the tests on which were made by Dr. H. C. Torrey, of the United States Mint. The velocity of the rubbings was 600 feet per minute, with 1,000 pounds pressure to the square inch and 1,200 revolutions per minute. The bearing surface was brought to such a handsome finish you could see your face in it. The average temperature was 127 degrees Fahr., taking the temperature of the room at 60 degrees.

Mr. C. Hussey, of 144 Greenwich street, showed me last week two new storage cells with apparently solid plates, which, it is claimed, give an E. M. F. of 3 volts per cell, and in fact this reading was given in my presence on a Carpentier voltmeter, each single cell giving 3 volts, and the two in series 6 volts. If the instrument was correct, this would seem to be the coming battery. Mr. Hussey also showed me a storage cell made by J. H. Bunnell for him some years ago of perforated plates of zinc folded together inclosing the oxides between them.

Mr. C. L. Clarke, the electrical engineer of the Gibson Electric Company, manufacturers of the Gibson storage battery. 74 Cortlandt street, will open offices in the Bryant Building, 55 Liberty street, as consulting engineer, at the same time retaining this position with the Gibson Company. His large experience in past years with the Edison Company, and later with the Telemeter Company, where he demonstrated the practicability of transmitting the readings of temperatures of all degrees to distant points, as well as many other applications, has brought him into great prominence in the electrical fraternity. He is thoroughly capable of undertaking the most delicate as well as the most elaborate details of electrical engineering construction.

The C. & C. Electric Motor Company, of this city, are very busy constructing motors for arc and incandescent circuits as well as for battery use. They have installed lately a 3 h. p. motor in Trinity Church to work the bellows which furnish air for the big organ, and started it up last Sunday for the first time. The organist states that he has tried every possible means in working the organ to exhaust the bellows, but could not do it. They formerly had four men to operate the bellows, and even then they have often become exhausted. The principal trade now is in large size motors of 3 to 20 h. p. Three 20 h. p and one 15 h. p were shipped to Harrisburg, Pa., last week; a 5 h. p. arc motor to Brooklyn, N. Y.; two of 10 and 3 h. p., respectively, are now running on the new Edison circuit in the City of Churches.

C. McIntire & Co., of Newark, had just received on the day of my visit last week an order for 5,000 lighting arresters for telephone switchboard use, the wires being of ½ ampère capacity. Also, 1,000 flexible cord copper terminals for incandescent lamps. They recently shipped 1,900 track bonds of iron wire and rivets for connecting the rails of electric street railways, and have filled an order for 2,500 of copper track bonds of No. 6 B. W. G., since Sept. 1; while 5,500 connectors, from No. 6 to No. 16 B. & S. were sent to Edison Company, Spokane Falls. This month's sales have been very large. Duplicate orders have been received from Seattle, Wash. Ter., for electric light connectors, from No. 6 to 16 B. & S., for the Northwestern Supply and Construction Company. Since Sept. 18 an order for 2,200 tinned copper sleeves, for Nos. 2, 4, 6 and 8 B. & S. wire and 500 No. 2 T branch sleeves for the subway work in New York has been filled.

Incandescent Lamp Sockets.—I called upon Prof. J. W. Collier a few days ago at his rooms in the Morton House and received a very cordial reception from him. Mr. Collier was the originator of the first Shook & Collier opera in Boston, as far back as the sixties, its success owing much to his mechanical skill, and now again his early education as a mechanician has served him in good stead. He is the inventor and patentee of a new socket and key for incandescent lamps entirely made of hard rubber, also a hard rubber socket with conductors attached that can be used for successful submarine lighting. Mr. Collier was associated with Shook & Collier in the Union Square Theatre for years, and was led to this invention while managing the work in the baths in Twenty-eight street, where the sockets in the electric lamps all rusted out and were the cause of trouble. The new socket will be of great value for damp places, as every part is made of hard rubber. The conductors are very ingeniously arranged and cannot be reached by damp. The sockets are ornamental, and have an exceedingly handsome finish.

An Electric Organ.—Having occasion to call on Mr. Brewer the other day at the factory of the Leclanché Battery Company in West Eighteenth street, my attention was attracted to a large number of reels of wire cable in the Roosevelt Organ Works. Upon inquiry, I was informed that this wire belonged to the big organ which was being got in readiness to ship to the Chicago Auditorium Association. Seven reels of cable are to be employed, each one containing from 83 to 111 feet of 33 conductor cable, made by the famous Bishop Gutta Percha Company of this city. I had the pleasure of meeting Mr. Roosevelt, who kindly showed me the complete organ in every detail. It occupies a floor space of about 10 by 20 feet, the key-board being about 12 feet above the base. The keys are all connected by the aforesaid cables to sets of contact points directly under the key-board and at the base, where all the working mechanism is contained. The pipes are separate and not a part of the construction above described. The seven different departments of the organ, namely: Great, swell, choir, solo, pedal, echo and stage organs are all controlled from the key-boards in the orchestra by means of the Roosevelt patent electric action. The keywork, which is a marvel of compactness, will extend downward into the basement beneath, and in this extension the great labyrinth of combination action and electric contacts will be contained. Every particle of this action, however, is easily accessible and and notwithstanding the magnitude of the organ and its wealth of mechanical resources, the system of construction is a paragon of simplicity and perfection. This organ will be larger than the one placed by this company in the Stewart Cathedral at Garden City, and the largest in the world. It will cost $50,000. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, Sept. 28, 1889.

Bangor, Me.—The Western Union Telegraph Company's office was entirely destroyed by fire last week.

Mr. Louis J. Hirt, M. E., well known as an expert engineer, has made his headquarters at 146 Franklin street, as agent for the Hill Clutch Works, of Cleveland, O.

Springfield, Mass.—The city authorities are putting in a large number of fancy lamp poles and mast arms all over the city, and have entrusted the work to the Marr Construction Company of Boston.

New England Electrical Wiring and Construction Company are at present engaged in wiring Young's Hotel, Boston, for a large increase in their lighting plant. They are also engaged in wiring the factory of the Plymouth Cordage Company, at Plymouth, Mass.

The Standard Electric Company of Vermont report the following sales: Brooklyn Theatre, 100-light plant; Andre Cardinal, Lakeview, N. J., 500-light plant; Chase Turbine Manufacturing Company, Orange, Mass., 150-light plant, and the Brown Lumber Company, Whitefield, N. H., 100-light plant.

Wheeler Reflector Company.—As an evidence of the value of the goods manufactured by this company it is only necessary to say that they are now to be found in the catalogues of the Sawyer-Man Company, Electrical Supply Company, of Ansonia; Holtzer-Cabot Company, of Boston, and Seth W. Fuller & Co., of Boston.

$1,300 for an Electric Shock.—A boy in Lawrence, Mass., has just been awarded $1,300 and costs in a suit against the Edison Electric Light Company and the telephone company of that city. A dead telephone wire had crossed the electric light wire and hung low enough for the boy to touch. Consequence, severe burn and the above pecuniary damages.

Mr. Wm. F. Sherman, of Lowell, Mass., who claims that he is the inventor of the overhead trolley system, has formed a company to protect his patent rights, for which application was made in 1883, and has notified the several electric railroad companies using the overhead system to that effect. The company known as the Sherman Electric Power Company will at once proceed to look after their interests from that invention.

Visitors from Philadelphia have recently been in the city examining the Thomson-Houston system of electric railroads as seen on the West End road. Philadelphia men require encouraging, and it is to be hoped, if they do order any motors, they will order them to run at a slightly higher rate of speed than the cable cars which are in use in the Quaker City to-day. Philadelphia is waking up, and that right in the middle of the last quarter of the nineteenth century, and is beginning to wonder if she can ever catch up with her sister cities and get ahead of them.

The Walworth Manufacturing Company are enjoying great success with their steel and iron poles for electric light and railway companies, as the various companies begin to realize the necessity for a pole which is light, strong, durable, and at the same time extremely neat. The most recent of their many large orders comes from Minneapolis, and they are shipping about 400 poles and brackets for the electric street railroad company. The West End Railroad Company continue to take the poles away as fast as they require them, and no better opportunity of judging their merits can be had than by visiting Boston.

The Thomson Electric Welding Company have within a few days been able to weld wire cable 1 5-1 inches in diameter for a cable to be used on a cable railroad, showing greater efficiency than was thought possible in doing this very difficult work. Although the strength of joints obtained by splicing was about 30 per cent that of the original cable, yet it was found from tests made at the Watertown Arsenal of electric welds made of this cable that 87 per cent. of the efficiency of the rope itself had been obtained in these welds. The Welding Company are overcrowded with orders, and are now making arrangements for increasing their works and for covering the country with salesmen as rapidly as possible.

The Gould & Watson Company are meeting with deserved success in the growing demand for their molded mica insulators. They continue to supply large quantities to the Sprague Electric Motor Company and the Thomson-Houston Electric Company, for superior quality of line work. For this class of work they are unexcelled, as having a metal core, they are actually imperishable, as well as possessing the highest possible insulating qualities. The Thomson-Houston Company also employ molded mica largely in the construction of their motors, and are more than satisfied with the result. Recently the Edison Company have shown considerable interest in this material, and are now preparing to give it a trial.

Wainwright Manufacturing Company of Massachusetts.—The success of the Wainwright heaters and Wainwright condensers is undoubted, judging from the large number of orders they receive. These heaters have now become a necessity of every economically worked steam plant, not only from the marvelous results they give, but from their excellence of structure. Among the most recent sales may be mentioned the Pottsville Electric Light Company, Pottsville, Pa., one 300 h.p. heater; Greenfield Electric Company, Greenfield, Mass., one 100 h.p. heater; Smart, Patterson & Rice, Stamford, Conn., one 250 h.p. heater; C. Murphy, Beverly, Mass., one 50 h.p. heater; Carolina Oil and Creosote Company, Wilmington, N. C., one 200 h.p. heater; American Rapid Dredging Company, one 200 h.p. heater and one 200 h.p. condenser.

New Electric Light Corporations.—Bay State Electric Light and Power Company, Worcester; capital, $35,000. Frederick G. Davis, president; F. E. Pollard, treasurer. Uxbridge & Northbridge Electric Company; capital, $20,000. Ferdinand A. Wyman, president; A. S. Palfrey, treasurer. Randolph & Holbrook Electric Company; capital, $15,000. Ferdinand A. Wyman, president; A. S. Palfrey, treasurer. Needham Electric Company; capital $10,000. John R. Bullard, president; T. F. Robinson, treasurer. Blackstone Electric Company; capital, $10.000. John R. Bullard, president; T. F. Robinson, treasurer. Acton Electric Company; capital, $10,000. John R. Bullard, president; T. F. Robinson, treasurer. Hopkinton Electric Company; capital, $10,000. C. L. Claflin, president; T. F. Robinson, treasurer. Ayer Electric Company; capital, $5.000. Benjamin H. Hartwell, president; T. F. Robinson, treasurer.

The Thomson-Houston Electric Company have just closed another very important street railway contract. St. Paul and Minneapolis have determined to adopt the Thomson-Houston system for their street railways, and the contract bids fair to rival in magnitude the recent large order for the West End Street Railway Company, of this city. The University Park Railway and Electric Company, of Denver, Col., have also placed their business in the hands of the Thomson-Houston Company, and ere long will have four miles of track operated electrically. Milwaukee is also coming to the front in electrical street railway business. Altogether, the railway department of the Thomson-Houston Company have no reason to complain of dullness, and success is attending their untiring efforts to supply the general public with something more reliable and more humane than what may now be correctly entitled the old-fashioned method of propelling street cars by horse power.

The Robinson-Foster Motor Company.—A special dispatch from Peabody, Mass., of Sept. 21, says: "The committee appointed by the stockholders to examine the books and investigate the affairs of the embarrassed Robinson-Foster Electric Railway Motor Company have discontinued their work, being unable, they claim, to accomplish anything of consequence. They claim to have been handicapped by the directors, and have concluded it is useless to labor under such disadvantages any longer, as the annual meeting takes place next week, and it was impossible to present a full report before that time. The committee reached the opinion that the principal reason for the downfall of the company was the lack of harmony among the directors. The cash books showed that in April last the four original directors sold 10,000 shares into the treasury for $1 a share, and that the seven directors held among themselves over 84,000 shares. The receipts from the sale of stock were about $60,000, for which the company have to show their plant with an $8,000 mortgage on it, and some $5,000 worth of finished motors." A. C. S.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 Mallers Building, Chicago, Sept. 28, 1889.

The Detroit Electrical Works are presenting a convenient note book to their friends.

Port Huron, Mich.—The time for bids on lighting Port Huron has been extended until 4 P. M. Oct. 14.

J. W. Branch, Marengo, Iowa, has purchased a Westinghouse alternating incandescent plant.

The Springside Coal Mining Company, Pana, Ill., has secured the contract for lighting the city.

The Council Bluffs, Iowa, Electric Light and Gas Company has filed articles of incorporation.

Mr. H. E. Webb, of the Solar Carbon & Manufacturing Company, Pittsburgh, is having a successful southwestern trip.

Harry A. Kinney, the electrical engineer of Omaha, is installing an Edison three-wire central station of 500 lights at Tarkio, Mo.

The Indiana Water and Light Company has been organized at Indianapolis, with a capital stock of $250,000, in shares of $50 each.

J. K. Pumpelly, of storage battery fame, has painted some handsome views of scenery along the river near his new factory at Plymouth, Ind.

The Heine Boiler Company, St. Louis, have just shipped a 200 h. p. Heine boiler with standard setting to the Hill City Electric Light Company, Vicksburg, Miss.

R. J. Randolph, Chicago, has secured a contract from T. S. Ridge, of Kansas City, for the installation of thirty arc lights of the Excelsior Electric Company's system.

The Association of Sprague Agents will hold its semi-annual meeting at the Weddell House, Cleveland, O., on October 8. Mr. P. A. Dowd, of your city, is the secretary.

The Williams Engine Company, Beloit, Wis., have purchased of F. W. Horne a 40 h. p. Excelsior Electric Company's generator, to be employed in operating their electric crane.

Henry C. Haskins, son of C. H. Haskins, of Milwaukee, Wis., and Miss Mollie Runyon, the eldest daughter of ex-Chancellor Runyon, were married on Thursday last at Elberon, N. J.

The Murphysboro Water Works and Electric and Gaslight Company has been formed, with a capital stock of

$60,000. Incorporators, George Kennedy, Jr., Willard Wall and George W. Hill.

Mr. F. G. Moss has been elected secretary of the Chas. Munson Belting Company, Chicago, to fill the place made vacant by the resignation of Mr. J. M. Thomas, who has severed his connection with the company.

The Interior Electrical Conduit Company, New York, have appointed the Southern Electrical Supply Company, St. Louis, special agents for their conduit system for concealed wiring in residences and office buildings.

The Ætna Machine Company, Warren, O., have received an order from the Terre Haute Iron and Steel Company, Terre Haute, Ind., for a 300 h. p. engine to drive a train of rolls in their rolling mill at Terre Haute.

Mr. James Bunn, of the St. Louis accumulator station, who represented the electrical interests in the Scripps expedition to Paris, has returned home, and speaks in high terms of the reception accorded them everywhere.

The Illinois Water and Light Company has been formed at Shelbyville to operate a water, electric light and gas plant. Capital stock, $3,000; incorporators, William T. Thornton, Henry C. Robertson and J. William Lloyd.

E. P. Allis & Co., of Milwaukee, have secured the contract for the installation of four Reynolds-Corliss engines aggregating 3,000 h. p., and each weighing 80,000 lbs., for operating the Lowrey Street railway lines in Minneapolis.

The Southwestern Telegraph Company has been organized at Chicago, to contract for and operate telegraph lines in Illinois and other States; capital stock, $50,000. Incorporators, F. P. Meyenburg, J. Howland Silver, and Y. C. Spencer.

The Minneapolis, Minn., Electric and Construction Company have succeeded to the business of the Minneapolis Electric Company. W. C. Thompson, L. L. Sandford and G. M. Jones, all of Minneapolis, form the company.

Charles H. Wilson, superintendent of the Chicago Telephone Company, and Miss Phœbe Hollister, daughter of Eli T. Hollister, were married at the residence of the bride's parents, 3,123 Thomas street, St. Louis, Mo., on Wednesday, Sept. 18.

The Kester Electric Company, of Terre Haute, Indiana, are placing two 50-light and one 25-light incandescent dynamos in the Faist, Kraus & Co. mill and adjoining elevator in Milwaukee Wis. Julius Andrae is installing the apparatus.

The Commercial Electric Company, Detroit, have met with gratifying success in securing contracts for electric light installations, and have wired numerous buildings for incandescent lights to be hereafter connected to central stations.

The Electrical Construction Company, of St. Louis, Mo., has been duly incorporated, and will be in full operation by the end of the month. The capital stock is $3,000, the shares being held by Benjamin A. Suppan, Charlas Stagl and John Stoker.

Webb C. Hayes, of the National Carbon Company, Cleveland, has been visiting friends in Chicago this week while en route home from a successful business trip in Colorado and Wyoming. Apparently the mountain air has agreed vastly with Mr. Hayes.

W. S. Andrews, of the Leonard & Izard Company, Chicago, will open an office in New York some time next month. Mr. Andrews is well known throughout the country, and will receive a hearty welcome from the fraternity in his proposed new home.

The Southern Electrical Supply Company, St. Louis, Mo., have issued a 336-page catalogue that is of value to all electricians. The company reports filling several large orders for Okonite wire, among the number being one for 40,000 feet of O. B. & S. gauge.

The Ravenna, O., Gas Company has offered to sell its electric light plant to the city for $13,000. The city council will pay $10,718, claiming that was the cost of same to the gas company, and if not accepted, will secure a Westinghouse plant set up complete for $10,621.

The Citizens' Electric Light Company, Belleville, Ill., which a few months ago secured a franchise there, and commenced erecting its plant, etc., has sold out its entire interests to the Brosius Electric Light Company, which has been in business there for several years past.

Theodore P. Bailey, Chicago manager of the Thomson-Houston Electric Company's railway department, reports the closing of contracts for the installation of their railway systems in St. Paul, Milwaukee and Denver, Col., the total cost of material and apparatus aggregating nearly one million dollars.

The Darche Electric Company, Chicago, have just issued a new pamphlet descriptive of their electric alarm clocks, illustrated in THE ELECTRICAL WORLD of Sept. 21, and for which numerous orders have been received, especially through local agents, who find it one of the best selling articles on the market.

George Cutter, Chicago, has received some vest-pocket screwdrivers of most convenient form for electricians, being constructed similar to pocket corkscrews, and arranged for attachment to key rings when desired. Mr. Cutter is also manufacturing a large number of cut-outs of special design, with porcelain base for an extensive instalation.

Messrs. J. H. Siegrist, Jr., & Co., 313 Olive street, St. Louis, Mo., have been appointed sole agents for the sale of the "Ide" and Ideal engines for St. Louis and adjacent territory. The firm will be glad to furnish propositions to any one in need of first-class electric lighting machinery. They are pleased to note a good trade in Brightman stokers.

The Marr Construction Company, 214 Boston Block, Minneapolis, Minn., have issued a neatly illustrated circular descriptive of electric light specialties used in line construction. This company is wiring the new hotel at Winona, Minn., and the Sykes building in Minneapolis, the specifications in both cases calling for the Standard Underground Company's wires.

Mr. William L. Church, superintendent of the Chicago Edison Company is quoted in Sunday's *Tribune* as follows: There is a great demand for electric lights for homes in Chicago, and I suppose the time will come, and probably in your day, when we shall have them. This company is now considering the erection of power houses on the south and north sides for this purpose.

Professor W. C. Richards, M. A., Ph. D., of 76 Bryant avenue, Chicago, is delivering a series of lectures on the wonders of magnetism and electricity throughout the West, that are of the most interesting character owing to the extensive apparatus used in illustrating same. Professor Richards is the author of "Elektron," and will shortly bring out a new edition of that work.

The St. Clair Steam, Heat and Electric Light Supply Company, of Belleville, Ill., are reported to have purchased the entire plant of the Citizens' Electric Light Company, consisting of real estate, building, steam plant, dynamos, circuit, etc., for $20,000. As the old plant was valued at about $50,000, the St. Clair Company now have some $70,000 invested in electric light and power plants.

Electric Club Notes.—Among the out-of-town visitors registered at the club parlors this week were Charles D. Shain, Cincinnati; A. H. Reece, St. Louis; C. R. Rusling, Kansas City; Robert Coleman, New York; George L. Colegate, Bryan, O.; J. W. Mercer, Ironwood, Mich.; C. S. Bundy, Bessemer, Mich.; H. C. F. Reimer, New York; William Halloway, Cincinnati; William H. French, Hyde Park; Webb Hayes, Cleveland; William Hubbard, Elgin, Ill.

Mr. C. R. Rusling, manager of the Kansas City office of the Thomson-Houston Electric Company, made a flying business trip to Chicago this week. In referring to the financial outlook in his territory, he spoke encouragingly regarding Kansas, intimating that the State will produce over 60,000,000 bushels of wheat and nearly five times that amount of corn; while the total gain in cereals, fruit, and live stock will aggregate in value nearly one hundred million dollars.

Mr. P. L. Rose, of St. Louis, has sold his interest in the Electrical Construction Company, of that city, to Charles Stagl and John Stoker, who will reorganize and incorporate as the Union Electric Construction Company, with a capital stock of $5,000, all paid in, divided in 50 shares of $100 each; twenty shares being held by John Stoker, fifteen by Charles Stagl and fifteen left in the treasury. Mr. Rose will devote his entire time to the purchase and sale of second-hand electrical machinery.

Mr. Charles D. Shain has resigned as general district agent of the Westinghouse interests at Cincinnati, and accepted a position under H. Ward Leonard in the offices of the United Edison Manufacturing Company in New York City. The electrical fraternity in New York are to be congratulated on this latest addition to their members, as Mr. Shain is a typical representative of the genial, whole-souled men who are promoting the welfare of the electrical industries throughout the West.

In Favor of the Bell Telephone Company.—Indianapolis, Ind., Sept, 19.—Judge Woods, of the United States District Court, granted an injunction in favor of the American Bell Telephone Company against Cassius Alley, restraining him from the use of telephones which Alley and others have had in operation in northern Indiana. It was decided that they were an infringement upon the Bell patents. Alley and his partners were ordered to surrender to the court all the telephone instruments in their possession.

The Lunkenheimer Brass Manufacturing Company, of Cincinnati, call attention to their recent extensive improvements for the manufacture of their goods. In addition to the construction of a new four-story brick building, they have added many new lathes, numerous other tools, and special machinery, which increase their capacity about 25 per cent. With their now increased facilities they are able to carry a large and complete stock, and can fill orders on short notice. Any orders placed with them will receive the very best attention.

The Electrical Supply Company, Chicago, have perfected arrangements whereby they are enabled to secure the entire output of a large mill equipped with improved machinery for turning out pins, cross arms, brackets, etc. They have also purchased the entire stock of poles in one of the largest yards in the lumber regions, and are thus enabled to fill orders for any quantity of poles, cross arms, pins or brackets without delay. This action was rendered necessary, owing to the enormous demand for pole line material that is constantly increasing.

Mr. F. W. Horne, of Chicago, is no longer manager of the Western department of the Excelsior Electric Company, of New York, having tendered his resignation to accept a more responsible position in an allied industry. During his nine years' service with the Excelsior Company, Fred Horne has made his mark by installing the system in almost every State east of the Rocky Mountains, and his valuable services will be missed, especially when competition is close. All his friends join in congratulations and in wishing him success in his new venture.

The Electrical Supply Company, Chicago, are noted for the large amount of printed matter they are constantly mailing to their patrons, and which partly accounts for their enormous sales. They are now bringing out a catalogue of electric light and power supplies that will be welcomed everywhere and preserved as a work of reference as well as a trade catalogue, as it contains data of much value to electricians—tables, etc. The printing and binding reflect much credit on the house, as does also the cover, which contains an artistic design of great merit.

The Ware Automatic Heat Generator and Regulator Company, Chicago, are placing a new device on the market, designed primarily to control the flow of gas, or oil, or gasoline, required for heating or cooking purposes, and to also control the temperature of the apartment. The system is patented by Mr E. B. Ware, of Chicago, the main device consisting of a double thermostat and a regulator operated with the aid of an electrical circuit connected to an open circuit battery. The entire apparatus was constructed by the Knapp Electrical Works, Chicago.

Superior, Wis., Lighting Interests.—A press dispatch states that Governor W. R. Merriam, A. H. Wilder, J. A. Barker, F. B. Kellogg, R. C. Elliott and John Mather, of St. Paul, have recently made investments in Superior aggregating $460,000. The gentlemen named own the Superior Gas Company, and on Oct. 15 will come in possession of the Superior Water Works Company and the Daft electric light plant at a total cost of $260,000. They will expend $40,000 this fall in improvements on the water works and electric light plants, which will make a total investment of $500,000.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone and electric light stocks as follows:

Chicago	$305@$310	Cumberland	$ 68@ $70
Central Union	57@ 58	Wisconsin	114@ 116
Michigan	85@ 86	Bell of Missouri	150@ 152
Great Southern	32@ 33	Iowa Union	24@ 25
Colorado	36@ 38	Missouri and Kansas	57@ 58
Rocky Mountain Bell	40@ 42		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$ 75@$ 80	Chicago Edison Co	$ 95@$100

The Hutchinson, Kan., Water, Light and Telephone Company have just purchased a fourth Armington & Sims engine required in driving Edison dynamos. A special feature is the placing of a clutch on the driving wheel, so arranged that the engine may run irrespective of the movements of the driving wheel, the same as though a line of shafting was employed. The Pond Engineering Company, of St. Louis, have installed the engine The same company have also furnished the Edison Illuminating Company, Topeka, Kansas, with a leather link belt and the Metropolitan Railway Company, of Kansas City, with a Tracy patent oil filter.

The Milwaukee City Council, at last Monday's meeting, advanced to a third reading the ordinance granting a franchise to the Edison Electric Light Company, this action being deemed equivalent to a passage. There has been a spirited fight on this movement. The Badger Electric Light Company is now furnishing the city with light in the business districts, and naturally opposed a rival company. The new company is composed of New York capitalists and Milwaukee business men. Should the franchise be granted and receive the Mayor's signature, work on the new plant will be begun immediately. The Edison incandescent light will be used, together with the Sperry arc light.

New Incorporations.—Citizens' Light and Power Company; location, Joliet; for the purpose of furnishing electric light, gas, heat, and power; capital stock, $150,000; incorporators, H. M. Kinsley, William W. Goodwin, F. G. Beach, William Henry White and Michael J Moran. The Enterprise Electric Light Company; location, Chicago; to operate an electric light plant; capital stock, $100,000; incorporators, Melville T. Roberts, Kenneth F. Griffiths and Alexis C. Burdick. Morris Electric Light Company, at Morris, Ill.; capital stock, $5,000; incorporators, Lewis Degen, Charles H. Kusel and H. L. Miller. Electric Street Railway Company; capital stock, $200,000; incorporators, Edward Blix, William Kron, W. A. Paulson.

Electrical Opportunities.—The opportunities offered in the electrical interests for rapid advancement to positions of great responsibility with corresponding emoluments will receive marked illustration within a few weeks in the West, when a well-known gentleman of great executive ability who has made a perfect success of everything yet undertaken, is popular, and a leader in all enterprises, will be tendered the management of a business aggregating in annual transactions many million dollars, relieving the present manager, who, having amassed a comfortable fortune, is the more willing to retire in knowing that the great business that has been built up practically in four years will be placed in the hands of one so thoroughly competent to carry it on.

Improved Exhaust Heads.—Lyman's "A," or improved exhaust heads, are being used extensively all over the United States and Canada for electric plants and otherwise. Recent shipments embrace a large territory, the following cities being among the number: New York City; Boston, Mass.; Binghamton, N. Y.; Greenpoint, N. Y.; Manchester, N. H.; Providence, R. I.; Pittsburgh, Pa.; Kansas City, Mo.; Topeka, Kan.; Denver, Col.; Portland, Ore.; San Francisco, Cal.; Los Angeles, Cal.; Nashville, Tenn.; Birmingham, Ala.; Montgomery, Ala.; Buenos Ayres, S. A.; Toronto, Can. The manufacturer, W. C. Lyman, 48 Michigan street, Chicago, Ill., does not confine himself to making the above style only, as recently he constructed six special shaped exhaust heads for steam power of electric light plants, where the lack of space in the interior of rooms had to be considered.

The Northwestern Electric Supply and Construction Company, of Seattle, W. T.—This company are agents for the Edison incandescent system and the Sprague Electric Railway and Motor Company. They are prepared to furnish careful estimates for the electric equipment of street railways and power transmission for mines and mills, steam and water power plants especially designed for electrical purposes. They have sold and installed most of the electric light plants in the Northwest. They are now building 14 miles of electric road in Portland, and some 17 miles of the Sprague system is being constructed in Tacoma. This company are installing 1,700 lights of the Edison system in the hotel Portland; 500 lights are to be placed in the Oregon Insane Asylum, and they are busy placing a number of small plants all over the State. S. Z. Mitchell is the president of the company; W. P. Noble, vice-president, and W. J. Grambs, secretary and treasurer. The company have offices in the Shorey Building, corner Third and Columbia streets.

Supt. A. M. Mozier, of the Western Division of the N. Y., P. & O. Ry., has adopted and is about to put into operation on his division a new and important device to prevent train accidents. It is a rule for station agents to keep train signals at danger point, and at the approach of a train turn the signal to safety point, and after its passage to restore the signal to its normal danger indication. It often happens, however, that when an expected train has a clear track ahead the station agent hooks down his semaphore to the safety signal and leaves it there. A call from the wire distracts his attention, and in the urgency of other business the misleading semaphore is temporarily forgotten, and trains which should be held for orders or otherwise get by at the risk of collisions. The device which Mr. Mozier has adopted is a shunt circuit so connecting the semaphore and the operator's key that when the safety signal is displayed the key cannot be used. The result is that the agent must keep his signal at the normal danger point. Any remissness is speedily drawn to his attention by an attempt to use the lines.

The Detroit Electric Light and Power Company, Detroit, Mich., has been formed, and the following officers and directors elected, and the general offices established in the Buhl block: William B. Moran, President; Gilbert W. Lee, Vice-President; Joseph B. Moore, Treasurer; William Fitzgerald, Secretary. Directors: William B. Moran, Francis F. Palms, George M. Vail, Joseph B. Moore, William H. Fitzgerald, Gilbert W. Lee, R. T. McDonald. All the local directors are gentlemen of high social and business standing, while their combined wealth will aggregate something like forty million dollars. The company have been especially fortunate in securing the services of Mr. William Fitzgerald, for several years superintendent of the Brush Electric Light Company, of Detroit, one of the most prosperous lighting companies in the country. While Mr. Fitzgerald is the nominal secretary of the company, it is presumed that he will also be the general manager. His experience is too valuable not to have it directly applied in the working of this new organization, as there is probably no one better acquainted with the interests involved than Mr. Fitzgerald, who has shown his faith in the stability of the enterprise by investing all his capital therein.

The Libby Prison War Museum, Chicago, was thrown open to the press last evening through the courtesy of Mr. Gunther and the guests entertained in a handsome manner. The building and surrounding grounds are lighted throughout by electricity, a 20-light Sperry plant, driven by a 30 h. p. Armington & Sims engine furnishing the arc lights, while two 20,000-watt Edison compound wound automatic machines, running in multiple arc and belted direct to a 90 h. p. Armington & Sims high-speed engine, furnish the incandescent lighting. Six hundred and fifteen 16 c. p. Edison lamps have been arranged in clusters of three and four lights each on fixtures of special design, harmonizing with the plain decorations of the interior, which presents practically the same appearance as when occupied by Federal officers, with the exception of the added relics and the electric lights. The switchboard, regulator, etc., present a handsome appearance, the dynamos being connected to the former by means of highly polarized bare copper rods, while an improved ampère meter is furnished for each machine. The entire plant was installed by the Chicago Edison Company, under the personal supervision of Mr. L. A. Ferguson and J. H. Goehst, to whom belong all credit for the handsome installation. Munson belting is used,

The Heisler Electric Light Company, of St. Louis, report a gratifying increase in their business. They are furnishing a plant of three hundred 30 c. p. lights to the Standard Light and Power Manufacturing Company, Montpelier, Vt. These lights are to be rented at a distance of four miles from the station. They are furnishing a plant of the same capacity to Frank Filer, Ludington, Mich., where

arc lights have been operated exclusively heretofore. Another plant goes to the Globe Furniture Company, Northville, Mich., for public and commercial lighting. An extensive plant is being prepared for the North Broad Street Farmers' Market uilding in Philadelphia, and will be in operation at an early day. Another extensive plant is nearly ready for shipment to Henry Joel & Co., Finsbury, London, E. C., England, being the first Heisler installation in England. The Heisler stations at Hackettstown, N. J., and Matteawan, N. Y., have placed orders for large increase in capacity, the order for the latter being for their fourth Heisler dynamo. The Heisler display at the St. Louis Exposition continues to attract wide-spread attention, and a similar display is now being prepared for the Texas State Fair, to be held at Dallas from Oct. 13 to 27. In both of these cases a handsome rental is paid for the Heisler ights.

The St. Louis Exposition.—"American Night" at the St Louis Exposition was a great success. A huge tableau was presented showing Columbus landing at San Salvador in 1492. In the centre of the tableau was a large alcove, draped on all sides with large American flags of silk, while on a pedestal covered with a flag in the centre of the alcove stood a young lady representing the Goddess of Liberty. Below her on the left stood an assistant goddess, who, from the shock of ripe wheat, standing near her, was seen to preside over Agriculture. On the right of the Goddess of Liberty was another associate Goddess who had her hand resting on a large iron wheel, signifying that she presided over Machinery. At the feet of the Goddess of Liberty was perched an American eagle with sweeping wings extended, and carrying an incandescent light at the tip of its beak. Just in front of the alcove and at the right was a ten-horse power electric motor of the Excelsior Electric Company, of New York, which was belted to a 100-incandescent light dynamo on the left side of the alcove, both machines running at a high rate of speed in furnishing the current for the 100 incandescent lights that sent forth their dazzling rays for the illumination of the tableau. The eight large arc lights that were used in the rear of the tableau were from the Western Electric Company, of Chicago.

An Automatic Photographist.—Next week Matthew J. Steffin's device for automatically producing photographs in exchange for a quarter dropped through a slot will be ready for the market. The invention is patented, and the mechanism operated by two separate and distinct electrical circuits. In securing a photograph the quarter is passed through a slot and the visitor takes the desired position, and then gives a slight pull to the cord in front of the cas, when the shelter in front of the lens of the camera is automatically drawn aside, and the flashing of some magnesium in a brass pan, fired by the heating to incandescence of a platinum wire, throws the necessary lights, and a perfect negative is secured on a plate having a white background and made of flexible celluloid. This part of the operation requires but two seconds of time. The visitor then waits while the plate is rolled over two small wheels and gripped by two rubber tapes, which carry it through the developing, fixing and washing fluids, and finally passes it through a second aperture or slot a perfected photograph, much superior to the ordinary tin-type. The entire movement of the second operation is controlled by an electric motor operated by a current from a primary battery. The necessary chemicals are each supplied separately from an air-tight reservoir, and the flow regulated by a dial apparatus to correspond with the temperature of the atmosphere and the strength of the chemicals. The machine will be placed in drug stores and other places where "slot" machines are found to pay. It is said that this device can be used in securing instantaneous photographs of criminals while they are being booked, and that it will be used by railway companies to prevent improper use of mileage tickets, though the success of this latter application is doubtful. The model of the machine was made by the Franklin Electric Company of Chicago for the inventor, who is a well-known artist of Chicago.

F. DE L.

PACIFIC SLOPE NOTES.

SAN DIEGO, Cal., Sept. 16, 1889.

The 30-foot Poles of the San Diego Gas and Electric Light Company, and the 40-foot poles of George D. Copeland's Westinghouse Company, are being taken down by order of the San Diego City Council, and in their place the companies are jointly erecting and occupying 45-foot poles.

The Western Union Telegraph Company is constructing a line from San Diego to Lakeside, a distance of 26 miles, along the track of the new San Diego, Cuyamaca and Eastern Railroad Company's road. Both the line and the road will soon be completed across the desert to a junction with the Southern Pacific at Dos Palms, San Diego County.

The "Divil's Own Stame."—An Irishman who was riding on a motor car in the electric road in San Diego during its operation was rudely startled by a flash caused by the motor switch being thrown open. After he had been persuaded to resume his seat on the car and had become somewhat composed, he ventured the opinion to the motorneer that "Faith, an' shure, that's the divil's own stame."

Electric Rapid Transit.—For some months the plant of the Electric Rapid Transit Street Car Company of San Diego has been lying idle, and recently the Fourth, Fifth, and Palm streets franchises of the company, together with its rails, etc., have been sold to a cable syndicate of Philadelphia capitalists, and now the track is being torn up preparatory to the building of the cable road. The work on the latter enterprise was commenced in earnest last week, and already two blocks of the cable track, with its yokes, conduit, etc., has been laid. The abandonment of the electric road, which was of the Henry patent, was in no wise due to the inefficiency of the system. It was built under subsidies from real estate "boomers" for the purpose of selling outside properties, and when the days of wild speculation were past, the road had no object for its existence, hence its abandonment. If, instead of building out into the realms of the jack-rabbit, the road had been extended an equal distance into the suburban residence portions, it would to-day be returning good dividends. The verdict in San Diego is, since the road began nowhere and ended nowhere, what could you expect? An effort is being made to form a stock company for the purpose of introducing electric power in San Diego. Geo. P. Low, the electrical contractor, is at the head of the movement.

Some Funny Insurance Rules.—A few days ago a letter was written from San Diego to a leading insurance firm of San Francisco asking for information concerning incandescent electric lighting and its relation to fire risks on the Pacific coast. The letter was referred to the Pacific Insurance Union (which is a "compact," composed of all the insurance companies on this coast) for an opinion, and in due time a reply was received from C. M. Nichols, the Chief Surveyor of that association, which stated that although the Pacific Insurance Union had not adopted any rules in reference to lighting by electricity, still the following general requirements, which are quoted verbatim, should be insisted upon: "The conducting capacity of all circuits for electric lighting must be sufficient to prevent any undue heating of the wires; in no case should the temperature of the conductor exceed 18 degrees Fahrenheit. All wires must be covered with some material of high insulating power. All joints must be so made that a perfectly secure connection will be insured, and they must not be soldered, but must be covered with some insulating substance. All joints must not be soldered, but conductors should be constructed with as few joints as possible." According to this official opinion from the fountain head of the insurance business of the Pacific coast, electricians in the far West, while saved the trouble of soldering joints, etc., are put to the inconvenience of placing refrigerating boxes about incandescent wires, and of maintaining therein a temperature of 14 degrees below freezing, for in no other way could the insurance requirements be complied with.

S.

THE TELEGRAPH.

The Galveston Cable.—The Atlas Company's steamer "Alps" has been chartered by a telegraph company and will for some time be engaged in repairing the Galveston cable.

THE TELEPHONE.

The Alabama, Mississippi & Tennessee Telephone Company has been formed by Mr. G. A. Lippincott and others with a capital stock of $50,000.

THE ELECTRIC LIGHT.

Cooperstown, N. Y.—The gas and electric companies have consolidated.

Durham, N. C.—W. Duke, Sons & Co. will put a 500-light Edison plant in their tobacco factory.

The Hill City Electric Light Company, of Vicksburg, Miss., is building a station 47 by 100 feet.

Canton, N. Y. was visited by a fire last week, which wiped out among other things, the electric light plant.

The Victoria, Tex., Power, Light and Ice Company will put in a plant. The capital stock is $25,000. T. M. O'Connor, G. H. Levi and others are interested.

The Monticello Electric Light Company has been formed by H. Kries, A. H. Krays, E. H. Sherwin and A. F. Barker, of St. Paul, Minn., with a capital stock of $5,000.

Lawrence, Mass.—Mr. Alexander, of the local Edison Company, was recently presented by the employés with a solid gold non-magnetic watch, as a token of esteem.

Buenos Ayres.—An Edison plant has been put in the Lavaderos Publicos by Mr. C. V. Boisot, who has also secured a contract for an Edison plant to go in the station and workshops of the Pacific Railway at Janin.

The Westinghouse Electric Company's large factory at Pittsburgh was visited by fire on Friday last and very serious damage was done, the third and fourth floors being completely gutted. The loss is covered by insurance. Rebuilding and repairs will begin at once.

Southern Notes.—The plant at the State Lunatic Asylum, Columbia, S. C., is to be enlarged. Georgetown, Ky., is considering the erection of a plant. The Brunswick Electric Light Company have been moving and enlarging their plant. The Rome, Ga., Gas Company will do the public electric lighting. Mr. W. A. Robinson has purchased the Athens, Ga., Gas Company and will carry out the electric light contract with the city.

The National Electric Light and Power Company, of Philadelphia, are rapidly increasing their isolated business, of which they are making a very successful specialty. Their office force is pushed to its utmost to keep up with the demand for estimates which are flowing in with increasing rapidity on account of the excellence of their work and the reasonable terms they offer. Mr. Charles E. Hague, late of the Accumulator Company, and afterward with Tracy, Hague & Co., has taken charge of the general outside work, and the prospects of the company are very bright.

Thomson-Houston Plants.—The following orders for central station apparatus and isolated plants have been received by the Thomson-Houston Electric Light Company, of Philadelphia, since the beginning of the present month: Bridgeton Electric Light Company, N. J., 650 inc.; Camden Electric Light Company, N. J., 1,300 inc., 50 arc; Carlisle Gas and Water Company, Pa., 1,200 inc.; Bradford Electric Light Company, Pa., 650 inc., 50 arc.; Chester Rolling Mills, Pa., 35 arc; Hudson County Electric Light Company, N. J., 1,300 inc., 200 arc; Mountain City Electric Light Company, Altoona, Pa., 1,000 inc.; Johnstown Electric Light Company, Pa., 100 arc; Germantown Electric Light Company, Pa., 3,250 inc., 50 arc; Huntingdon Electric Light Company, Pa., 650 inc., 50 arc; United States Electric Light Company, Philadelphia, 50 arc; S. L. Allen & Co., Philadelphia, 400 inc.; Feister Printing Company, Philadelphia, 20 arc; International Tel., D. & C. Company, Baltimore, 600 inc.; Abeyfoyle Manufacturing Company, Chester, Pa., 50 arc.

APPLICATIONS OF POWER.

San Jose, Cal.—A franchise has been granted for an electric road with overhead connection.

Chattanooga, Tenn.—The Chattanooga & Northside Street Railway Company will operate by electricity.

Knoxville, Tenn.—The Knoxville Street Railway will soon make the contracts for its electric plant and general equipment.

Elgin, Ill.—The Elgin street railways are to be equipped with electric motors, and an investigation of the subject is now being made.

Lexington, Ky.—The Lexington City Railway Company will put in a plant to supply current for their road, now to be run by electricity.

Concord, N. C.—An electric road is to be buit between Concord and Mt. Pleasant, and the latter place has voted $24,000 toward he necessary grading.

The National Electric Motor Company has been formed by J. R. Simpson, W. G. White, W. E. Amos and others with a capital stock of $250,000.

An Elevated Road for St. Louis is projected, to be run by electricity. All the money necessary has been raised, and work will begin very soon. The British-American Investment Company are back of the enterprise.

Florence, Italy.—Work has begun at the Edison Machine Works, Schenectady, on the Sprague apparatus for Florence, Italy. The road will be five miles long, from Florence to Fiesole, with extremely heavy grades. The regular Sprague overhead system and motors will be used.

The Short Electric Railway Company have secured the contract for building and equipping an electric road in Muskegon, Mich. Four and one-half miles of track will be relaid at standard gauge with 30-lb. Johnson rails, and five new closed motor cars will be added to the stock on hand. A Brush generator, 125 h. p., and five 18 h. p. motor trucks, with complete station equipment, will be furnished. Work on the overhead construction will be begun at at once, and it is expected that the road will be in operation by Dec. 1.

New Sprague Roads.—During the last week there have been a number of street railway companies which have contracted for electric railway apparatus in spite of the lateness of the season. The latest contracts closed by the Sprague Electric Railway and Motor Company, of New York, are for street railways in Piqua, O., and South Nashville, Tenn. The road at Piqua is an entirely new road, never having been operated by any power before. The number of cars which will be equipped will be four, and the line will extend for a few miles on the main streets of Piqua. The South Nashville Street Railway Company will equip eight cars at present, but it is expected that the entire road will be run by electric power before long.

Richmond, Va.—For some "inside" reason, a desperate effort has lately been made to depreciate the value of the electric road at Richmond and incidentally to injure the reputation of the Sprague system. It is supposed that a stock-jobbing deal there is on hand The road is, however, an excellent piece of property, and the merits of the Sprague system are too well known to be affected by efforts of this nature. It is said that a change for the better in the management, which has been utterly disgraceful, may soon be effected. A new board of directors was elected last week as follows: Henry Steers, T. N. Motley, James S. Smith, Joseph A. Flynn, Peter Hall, A. Pizzini, Jr., E. H. Johnson, E. F. Lathrop, Wyndham R. Meredith, Richard Newcomb, Dr. William H. Scott and E. E. Gedney. All of these are from New York, except Dr Scott and Messrs. Meredith and Pizzini, of Richmond. The board will meet in New York for organization in a few days. Of the above named, Messrs. Motley, Steers, Smith, of New York, and Scott, of Richmond, are members of the present board.

PERSONALS.

Mr. Frank J. Sprague has returned from his European trip which has resulted in the introduction of the Sprague railway system in Italy.

Mr. A. R. Foote, of Cincinnati, has been appointed by Commissioner Porter a special agent to collect electrical data and statistics for the census of 1890. His appointment will date from next Jan. 1.

Mr. John A. Seely has retired from active connection with the Metropolitan Telephone Company, of this city, but will be retained by it as consulting electrician. He will devote his energies to the Complete Electric Construction Company and other prospering enterprises.

Charles D. Shain, formerly with the United States Electric Lighting Company, and lately general district agent for the Westinghouse interests at Cincinnati, has resigned and accepted a position in New York under Mr. H. Ward Leonard with the Edison Manufacturing Company.

Mr. J. B. McDonald, of the Illinois Anglo-American Storage Battery Company, Chicago, states that a very complete and extensive factory, for the manufacture of the Sorley cells, will be erected in that city at once. Mr. McDonald is also having plans drawn for a pleasure yacht, the motor power to be operated entirely by current from the Sorley storage cells.

MISCELLANEOUS NOTES.

The American Institute Fair, this city, opens this week for the fifty-eighth annual exhibition. A good display of machinery is promised.

The American Electrical Supply and Appliance Company has been formed under the laws of Virginia with a capital stock of $500,000. Mr. F. E. Marrin, of Brooklyn, N. Y., is president of the company.

A New Train Signal System was shown recently at Pittsburgh by the inventors, T. D. Williams and J. S. Lucock, of the Western Union service. The main idea consists in setting the signals by the contacts formed by steel brushes or brooms at the front and rear of a train.

The Association of Fire Underwriters of Missouri, Kansas and Nebraska held its twelfth annual meeting at Excelsior Springs, Missouri, last week, and strongly recommended that Kansas City increase her electric fire alarm system at once, in order to afford better protection to property.

A Change of Base.—Our excellent and highly esteemed contemporary, *Industries*, has removed its headquarters from Manchester to London, where the chief offices are located at 358 Strand. The Manchester and Glasgow branch offices will be maintained. We think that considerable benefits are likely to be derived from this change of base.

How About the Passengers' Watches?—A Brazilian inventor proposes to anchor the dishes to a ship's table by means of electro-magnetic attraction. He will insert a piece of soft iron in the dish, and inlay the same material in the table and turn on the current, the attraction being strong enough to neutralize part of that terrible uncertainty of location which characterizes one's dinner on the ocean voyage.

A New Insulating Substance.—A by-product resulting from the treatment of asphalte with sulphuric acid, which has hitherto been considered of no value, has, says *La Lumière Electrique*, been found to furnish an excellent insulating material. This substance, which resembles ordinary asphalte, becomes, after exposure to great heat, as hard as ebonite or vulcanite, and possesses high insulating properties.

Edison Honored.—The Grand Cross of a Commander of the Legion of Honor has been bestowed upon Thomas A. Edison. M. Spuller, Minister of Foreign Affairs, in conferring the decoration upon Mr. Edison, said that it was given in honor of the services rendered by him to science, and for the part taken by him in the Paris Exposition. M. Spuller also said that America was splendidly represented at the Exposition, and that the presence of her exhibits testified to the indissoluble bonds which bind France and America together.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y.. No. 105 South Warren street.

Patterson, Gottfried & Hunter (Limited), 146-148 Centre street, carry a complete stock of Brush copper, celluvert fibre lined paper, hard rubber, rod and sheet brass, brass, copper and iron wire, self-hardening tool steel, set and cap screws, machine bolts, machine and wood screws, taps and dies, files and twist drills, blowers and forges, machinery, tools and hardware, gear wheels, wood pulleys, shafting hangers and belting. General factory supplies.

SEMON BACHE & Co.,
Nos. 443 to 453 Greenwich street,
NEW YORK, Sept. 24, 1889.

To the Magnolia Anti-Friction Metal Company, 74 Cortlandt Street, New York:

GENTLEMEN: I am in charge of an "Edison" plant for the above-named house, consisting of two dynamos running about four hundred lamps. The bearings heretofore were of the C. F. Hooks genuine Babbit metal, put in by the W. & A. Fletcher Co., of West St., N. Y. Still, for all, I had nothing but trouble. The journals would get hot and smoke every day regardless of the quantity of oil in use, and on more than one occasion it was actually necessary to cool them off by the use of ice. I noticed your "ad" in THE ELECTRICAL WORLD, and made my mind up to give the Magnolia Metal a chance. I am well satisfied with the result, for I now have cool bearings and save a large amount of oil; besides the dynamo runs free and the shaft has an elegant polish on it. I believe the Magnolia metal will prove a success where every other metal is found to be a failure. If possible, I will introduce your metal wherever there is any chance, for it is really the standard metal of the day. I am, yours respectfully,

(Signed) NELSON FRAZIER,
Electrical Engineer.

OFFICE OF TRUSTEES OF N. Y. AND BROOKLYN BRIDGE,
BROOKLYN, March 1, 1889.

G. W. Gallaway, Esq.—DEAR SIR: In reply to yours of Feb. 28, I would say that the Waste Oil Filter purchased from you Dec. 18, 1888, has given entire satisfaction. We are saving with it about three gallons of oil per day, the only expense connected with it being the renewal of the cotton about once a week at a cost of ten cents. Very truly yours, FRED'K D. HART.
Engineer-in-Charge Cable Engines N. Y. and Brooklyn Bridge.

The Taylor Manufacturing Company, Chambersburg, Pa., report installations and sales of Beck automatic engines during the past few weeks, as follows: one 12½x15 Beck engine, with boiler, complete, for Edison Electric Light and Power Company, Roanoke. Va.; one 11½x15 engine, with complete steam plant, to Schuyler Electric Light Company, Alexandria, Va.; one 9½x12 engine to Y. M. C. A., Detroit, Mich., second order; second complete steam plant, 10½x12 engine to Piedmont Electric Light and Power Company, Piedmont, W. Va.; one 16x18 engine, with boiler, to S. Hinkle & Co., Rowlesburg, W. Va.; one 5-inch by 6-inch vertical automatic engine (third order) to C. C. Mengel, Jr., & Bro. Company, Trimble, Tenn.; one 13½-inch by 24-inch engine to Chattanooga, Tenn., Mill Company; one 10½x12 engine, with complete steam plant, to Thomson-Houston Electric Company, Eufula, Ala.; one 13½ x15 engine, with complete plant, to Knoxville, Tenn., for Schuyler Electric Company; one 15x18 engine to Fort Payne, Ala., Electric Light, Power and Heating Company; one 14½x18 engine to Tennessee Paving Brick Company, Robbins, Tenn.; one 10½x12 to Demens & Taylor, Asheville, N. C., also boiler; one 9½x12 engine, with boiler, to Staley Cotton Mills, Staley, N. C.; one 10½x12 engine for W. H. Sims, Temple, Tex.; one 8½x10 to Fort Payne, Ala., Coal and Iron Company; one 11½x15 engine (second order), to Wissahickon Electric Light and Power Company, Philadelphia, Pa.; one 11½x15 engine (second order) to Meridian Miss., Electric Light and Power Company; one 11½x15 engine, plant complete, to Sycamore, Ill., Electric Light Company; one 14½x18 engine for Sternberg Mill and Elevator Company, Boulder, Col.; one 14½x18 engine for Billings, Mont., Woolen Mills; two 15x18 for Endicott Office Block, St. Paul, Minn.; one 8½x10, Hicksville, Ohio, Electric Light and Power Company; one 10½x12, with plant complete, to Athens, Ohio, Gas Light and Electric Company; one 12½x15 engine, with plant complete, to E. S. Trussell, Pomeroy, O.; one 8½x10 engine, with plant complete, to M. S. Robinson, proprietor Wonderland Theatre, Buffalo, N. Y.; one 9½x12, with boiler, to U. C. Darby, Weverton, Md.; one 9½x12 engine, to Eureka Electric Company, New York; one 10½x12, to McConway & Cooley Company, Pittsburgh, Pa.; one 12¼x15 engine, to Andover, Mass., Electric Light Company, second order; one 13½x15, with plant complete, for Tarentum, Pa, Electric Company; one 9½x12, Abingdon, Va., Water Works Company; one 16x24 engine, for H. P. Gregory & Co., California; three 13½ inch x 15 inch "Beck" engines, with boilers, etc., complete, for the Watervliet Electric Railway, of Albany, N. Y., the longest railway in the country, Thomson-Houston system; one 10½x12 engine, for the Rouge River & Dearborn Railroad Company, Detroit, Mich, operating Sprague generators; two 11½x15 engines, for the Thurmond Coal Company, Arbuckle, W. Va., for driving electrical coal mining machines.

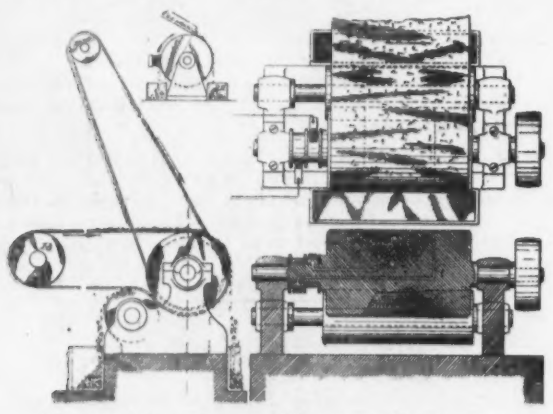
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENTS ISSUED SEPTEMBER 24, 1889.

Reissue. 11,031. System of Electrical Distribution; Rankin Kennedy, of Glasgow, County of Lanark, Scotland, Assignor, by mesne assignments, to the Westinghouse Electric Company, of Pittsburgh, Pa. Application filed August 28, 1889. The method of distributing and regulating alternating electric currents by secondary generators, which consists in producing in two or more derived circuits constituting the primaries of two or more secondary generators, a counter electromotive force which, when any secondary is open is practically equal to the applied electro motive force in its primary, and in controlling said electromotive force by the current flowing in the corresponding secondary when the secondary is closed in such manner that the current in the primary shall vary with and be approximately inversely proportional to the resistance in the secondary.

411,414. Electro-magnetic Separator; William A. Anthony, of Manchester, Conn., Assignor to the Mather Electric Company, of same place. Application filed June 28, 1889. The combination of a revolving electro magnet and an endless non-magnetic apron carried thereby and adapted to carry mixed magnetic and non-magnetic bodies in those substances at one place with a roller revolving parallel to the electro-magnet and under the endless apron, and adapted to hold the magnetic bodies in those substances between it and that apron, and thus to carry them far enough out of the magnetic field to enable them to drop at another place when released from between the roller and the apron.

411,423. Safety Switch for Incandescent Lights and Other Electrically Controlled Devices; Oscar S. Bussmann, of Somerville, Mass., Assignor to the Bernstein Electric Light Manufacturing Company, of Portland, Me. Application



No. 411,414.—ELECTRO-MAGNETIC SEPARATOR.

filed Oct. 12, 1887. The invention consists in the combination with an electric switch adapted to be manually or otherwise operated to cut into or out of circuit one or several electrically operated devices, of an automatic circuit-changing device or contact maker normally held inoperative by fusible material and adapted to operate and change the condition of the circuit,

411,426. Process of Generating Electricity by Gas Batteries; Olof Dahl, of Brooklyn, E. D., N. Y. Application filed June 17, 1889. The process of generating electricity consisting in first, raising the temperature of a body of fuel to incandescence by the aid of atmospheric air, and utilizing the gases evolved in this operation for fuel and other purposes; second, shutting off the air and admitting steam to the incandescent fuel when it has reached such a temperature that the admitted steam will be decomposed into hydrogen and carbonic acid; third, separating the carbonic acid from the hydrogen, by causing hydrate of lime to absorb the carbonic acid, and conducting the hydrogen to one side of a gas battery, or gas batteries; and, fourth, producing oxygen or equivalent gas and conducting it to the other side of the above-mentioned gas battery or gas batteries.

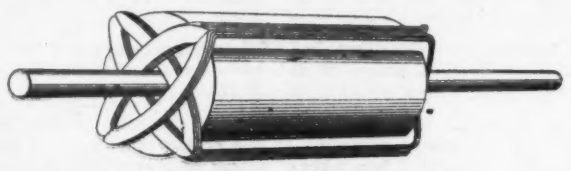
411,427. Conduit for Electrical Wires; Charles C. Dashiell, of Washington, D. C. Application filed Nov. 17, 1888. In an electrical conduit, pipes having laterally projecting lugs, in combination with couplings having slots adapted to register with said lugs, said couplings having an exterior screw thread upon their free ends and a ring having an interior screw thread adapted to connect said couplings.

411,452. Philip H. Klein, Jr., of New York, N. Y., Assignor to Bergmann & Co., of same place. Application filed May 25, 1889. A tap fixture for electric wires, comprising a base, channels extending across said base, channels at approximately right angles to the first named channels, binding plates in the channels, binding screws for the wires, and a safety catch, the said base having an opening to engage over a gas pipe connection.

411,471. Manufacture of Carbons for Incandescent Electric Lamps; John S. Sellon, of Hatton Gardens, County of Middlesex England. Application filed Jan. 23, 1888. Patented in England Aug. 15, 1888. In the art of manufacturing carbons or filaments for incandescent lamps, the improvement consisting in heating the same to a high temperature, by burning fluid fuel in a suitable furnace, and at the conclusion of the operation raising the temperature to a still higher degree for a short period by the introduction of a blast of oxygen.

411,496. George B. Fraley, of San Francisco, Cal. Application filed June 21, 1889. In an electric railway, a slotted underground conduit, a conductor extending longitudinally within said conduit insulated, supports extending over the sides of the conduit, pulleys journaled at intervals between the supports over which the ends of adjacent conducting wires are passed, and weights suspended beneath said pulleys from the ends of these wires.

411,539. Underground Conduit for Electric Wires; George A. Wheeler, of New York, Assignor of one-fourth to Syl-



No. 411,629.—ARMATURE.

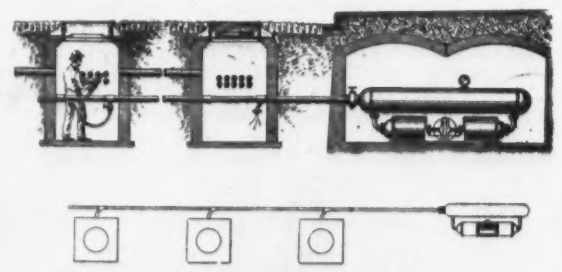
vester P. Denison, of Brooklyn, N. Y. Application filed July 29, 1889. In a conduit system, the combination, with the manholes and ducts, of a compressed air main having outlets at various points along the conduit that discharges a limited portion of the air.

411,551. Regulator for Shunt-Wound Dynamos or other Electrical Apparatus; Lander S. Harris, of Detroit, Mich. Application filed April 27, 1889. In combination with a field magnet and armature of a shunt machine, a group of wires leading to a field and a corresponding group of wires having a variable resistance leading to the armature and switch mechanism connected to said wires, so that when there is a maximum of current through the field magnets there shall be automatically provided a minimum current to the armature, and vice versa, the current to one decreasing as the current to the other increases by a single movement of the switch mechanism.

411,588. Telephone-Holder; Charles T. Dickson, of Cincinnati, O. Application filed March 15, 1889. In a telephone holder, of two parts, the stationary frame provided with a series of connection pins, to which the line wires are attached, said pins having enlarged heads, in combination with metallic spring switches pressing against the under surface of the pin-heads, and arranged to be displaced by the portable frame on the joining of the two parts.

411,595. Underground Conduit; David M. Hyland, of Chicago, Ill., Assignor of one-half to John P. Barrett, of same place. Application filed March 1, 1889. The invention consists in a chamber at the head of a cable, tunnel or conduit entering a building, through the sides or walls of which the cables are carried for distribution, this chamber being provided with an air-inlet and a vent connected with a flue, and so arranged that all objectionable gases coming through the tunnel will be carried off through the flue without being disseminated through the building.

(1) 411,611. (2) 411,612. Systems for Synchronizing Electric Motors; Robert Hamilton Read, of Washington, D. C. Applications filed (1) Feb. 12, 1889. (2) April 3, 1889. A system for synchronizing electric motors, comprising a controlling circuit, a current changer for producing periodic current changes in said circuit, two or more motors at distant stations, having field magnet and armature circuits, in one of which circuits current



No. 411,539.—UNDERGROUND CONDUIT FOR ELECTRIC WIRES.

varies in accordance with the changes in the controlling circuit, and a local current changer actuated by the moving part of each driven motor for producing corresponding changes in the other motor circuit, whereby a continuous driving effort will be maintained on the driven motor as long as the changes in the two motor circuits are simultaneous.

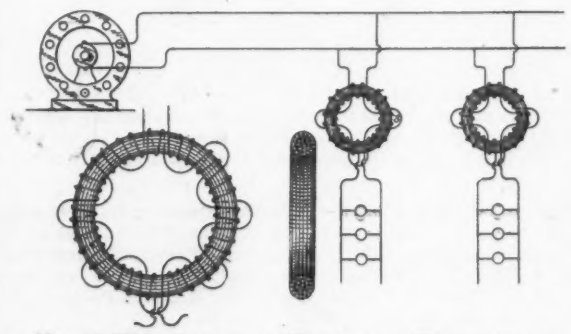
411,613. Trolley for Electrical Railway Systems; Andrew L. Riker, of New York City, N. Y. Application filed April 22, 1889. The combination of the support pivoted so as to turn on a vertical axis, the swinging arm pivoted to said support and capable of turning on its pivot, so as to incline either forward or backward and a spiral spring connected with said arm and support and tending to resist the bending of said arm in either direction.

411,629. Armature; Charles F. Winkler, of Hoosick Falls, N. Y. Application filed Jan. 26, 1889. The invention has reference to armatures for dynamo electric machines and motors. It relates particularly to the manner of applying or mounting the coils on the Siemens form of armature. The winding, instead of being the ordinary form of wire winding, is formed of plates or strips of iron having some considerable width. Each coil is made up of several turns of the strip. It is desirable that the longest diameter of the coils be as short as possible, in order that the armature may not be unduly lengthened by the crossing of the coils at the ends. I accomplish this by bending the ends of each coil over and away from the shaft and against the head of the armature drum. This shortens the coils and admits of another coil being adjusted over it. This latter in its turn is bent over to admit of the third coil being placed in position, and so on, the ends of each coil being bent over for the purpose described.

411,689. Electrical Attachment for Eyeglasses; Charles Cutler Smith, of Mohawk, and Herman W. Martin, of Ilion, Assignors to the Electrical Spectacle and Eyeglass Manufacturing Company, Limited, of New York. Application filed Feb. 8, 1889. An electric attachment for spectacles consisting of two T strips of different metals having their Ts adapted to be bent around the bridge of said spectacles.

411,713. Arc Lamp; Frank P. Cox, of Terre Haute, Ind. Application filed May 24, 1889. In an arc lamp the combination, with gearing to positively adjust the carbons of a freely and vertically swinging armature lever or frame pivoted at one end and having a pair of parallel arms, each provided with means respectively to operate said gearing in opposite directions to raise or lower the carbon, an electro-magnetic device directly acting on said lever to draw the same in one direction to operate the gearing to lengthen the arc, and an opposing shunt electro-magnetic device directly acting on said frame directly against the force of the main magnetic device to swing the frame in the opposite direction and actuate the gearing to lower the carbon.

411,737. Electric Water Heater; Daniel W. Smith, of St. Louis, Mo. Assignor of one-half to Joseph C. Addington, of same place. Application filed November 26, 1887. In a water heater, in combination with a boiler and a metallic dome or housing located therein, a steam pipe connected with said boiler and an



No. 11,031.—SYSTEM OF ELECTRICAL DISTRIBUTION.

independently enclosed electric heater having a metallic casing secured in the dome by means of a downwardly projecting flange and a collar screwed thereon.

411,742. Railway Signal, Alonzo B. Fisk, of Winthrop Mass., Assignor to the Gould-Tisdale Revolving Semaphore Company, of Portland, Me. Application filed Nov. 3, 1888. The combination of a shaft, a signal operated thereby, an actuator for rotating said shaft, an escapement for controlling the movement of said shaft, a main circuit, an electro magnet in the main circuit for releasing the escapement, an auxiliary circuit, a pivoted arm connected with the main circuit, and a cam-wheel on said shaft engaging said arm, and lifting it to unite both circuits when the shaft is turned.

411,749. Electric Insulator; Louis McCarthy, of Boston, Mass., Assignor to the Gould & Watson Company, of Massachusetts, and Charles Tennant Lee, of Boston, Mass. Application filed August 12, 1889. An insulator comprising a block having an enlarged and flaring or beveled sides, a frame or support having an aperture beveled or flaring at either end of the aperture, a cap adapted to be secured to either side of the frame, and a layer of insulating material interposed between the block and the frame and cap.

411,767. Mechanical Telephone; William H. Easton, of Concord, N. H. Application filed Aug. 6, 1889. In a mechanical telephone, the combination, with the transmission line, of a device for deadening extraneous vibrations, consisting of a liquid tight chamber filled with a suitable liquid, as water or alcohol, and a vibration conductor extending from the said chamber to the line wire.

411,770. Telegraph Key; Harry S. Tebbs, Nathan C. Lane and Vinton Coombs, of Washington, D. C. Application filed Dec. 18, 1886. In a telegraphic key, the combination with the key lever of a button connected thereto by a universal joint and mechanism whereby the button may be held in any position to which it may be adjusted.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times building, N. Y.